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Field Testing: Application of Combustion Modifications to Control Pollutant Emissions from Industrial Boilers Phases I and II (Data Supplement)

KVB Engineering, Inc., Tustin, California

Prepared for

Industrial Environmental Research Lab., Research Triangle Park, N.C.

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16. ABSTRACT The Data Supplement records individual data points in greater detail than practical in the Phase I and II reports. It is intended for researchers who wish to refer to individual data points. Data are included from 47 boilers tested in Phase I, and 19 boilers tested in Phase II. The Supplement contains design data on the boilers tested, fuel sample analyses, control room data, gaseous emissions data (NO, NO2, CO, CO2, HC, SO2, and SO3), stack traverse data, particulate mass emissions and size, opacity readings, smoke spot numbers, and boiler efficiency. Additional details, including measurement procedures, boiler descriptions, and interpretations of the influence of combustion modifications on emissions and efficiency are contained in the Phase I and II reports.

17. KEY WORDS AND DOCUMENT ANALYSIS

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FIELD TESTING: APPLICATION OF COMBUSTION MODIFICATIONS TO CONTROL POLLUTANT EMISSIONS FROM INDUSTRIAL BOILERS - Phases I and II (Data Supplement)

by

S.C. Hunter and H.J. Buening

KVB Engineering, Inc.
17332 Irvine Boulevard
Tustin, California 92680

Contract No. 68-02-1074
Program Element No. 1AB014
ROAP No. 21BCC-046

EPA Project Officer: Robert E. Hall

Industrial Environmental Research Laboratory
Office of Energy, Minerals, and Industry
Research Triangle Park, N.C. 27711

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Research and Development
Washington, D.C. 20460

Limitations On Application of Data Reported

The data cited in this report are pollutant emissions. These emission levels are suitable for use in estimating mass emissions from industrial boilers as a class and are useful in compiling areawide emission inventories. However, they are not suitable for predicting emissions from any one boiler or as regulatory limits or emission standards. Use of emissions as emission standards automatically would place a large proportion of the industrial boiler population in noncompliance.

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FOREWORD

The purpose of this Data Supplement Volume is to document data in greater detail than was practical in the final reports for this contract. It is intended to provide the necessary details to other researchers who are interested in performing their own analysis.

Readers are referred to the contract final reports for information as to objectives, selection of units, measurement procedures, interpretations and conclusions.[1,2]

All data presented for gaseous emission concentrations of NO, NO_2, CO, HC, and SO_2 are expressed in parts per million by volume (ppm) on a dry basis corrected to 1 percent O_2 by volume (dry) in the flue gas.

The data are arranged in this volume by Location Number for locations 1 through 19. A location is defined as one company or plant in which one or more boilers were tested. Each boiler tested at a location is identified by a unit number. The contract final reports frequently refer only to the test number when data are discussed. Table 1 presents a cross-reference list of test numbers and the corresponding location number for the tests conducted in Phase I. Table 2 presents a similar list for tests conducted in Phase II.

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[1]Cato, G. A., et al., "Field Testing: Application of Combustion Modifications to Control Pollutant Emissions from Industrial Boilers-Phase I," PB 238 920/AS, EPA-650/2-74-078a, October 1974.

[2]Cato, G. A., et al., "Field Testing: Application of Combustion Modifications to Control Pollutant Emissions from Industrial Boilers-Phase II," PB 245 500/AS, EPA-600/2-76-078a, April 1976.

TABLE 1. INDEX OF TEST NUMBERS AND LOCATION NUMBERS FOR PHASE I

Test Numbers	Location Numbers	Test Numbers	Location Numbers	Test Numbers	Location Numbers	Test Numbers	Location Numbers
1	19	26	12	51	23	76	N/A
2	19	27	14	52	19	77	12
3	15	28	14	53	15	78	12
4	5	29	13	54	19	79	N/A
5	1	30	9	55	26	80	10
6	7	31	11	56	26		
7	17	32	20	57	26		
8	20	33	3	58	5		
9	18	34	21	59	N/A		
10	16	35	26	60	4		
11	N/A[1]	36	15	61	N/A		
12	1	37	5	62	1		
13	2	38	4	63	2		
14	10	39	26	64	23		
15	9	40	23	65	6		
16	15	41	3	66	1		
17	15	42	22	67	1		
18	11	43	22	68	3		
19	21	44	26	69	2		
20	21	45	20	70	2		
21	18	46	24	71	20		
22	18	47	24	72	20		
23	9	48	26	73	24		
24	9	49	25	74	8		
25	6	50	N/A	75	13		

[1]N/A = test number not assigned.

For Tests 101-313 see Table 2.

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TABLE 2. INDEX OF TEST NUMBERS AND LOCATION NUMBERS FOR PHASE II

Test Numbers	Location Number
101-108	1
109-112	37
113-121	39
122-130	40
131-133	31
134-139	30
140-148	32
149-152	33
153-155	34
156-159	13
160-164	36
165-168	35
169	31
170-175	20
176-179	37
180-189	38
190-206	19
207-212	39

For Tests 1 - 80, see Table 1.

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For each unit tested, the data supplement contains the following information:

1. Industrial Boiler Design Data

   Design data tabulations include: unit description, installation date, steam conditions, furnace characteristics, burner type and spacing, fuels burned, and design temperatures for fuel, air and stack gas.

2. Boiler Emission Measurements and Control Room Data

   Emission measurements tabulated for each test include test type test load, combustion conditions (excess O_2, CO_2), gaseous emissions (NO_x, NO, CO, HC, SO_x, and SO_2 all at % O_2, dry), total particulates and solid (filterable) particulates, boiler efficiency, Bacharach smoke spot number, and plume opacity. Control room data tabulated include steam pressure and temperature, combustion air and stack temperatures, fuel flow, fuel temperature and pressure, furnace pressure, and burner air register setting.

3. Cascade Impactor Data

   Impactor data include impactor flow conditions, stage collection weights, and calculated aerodynamic particle size for each size.

   The impactor used was a Brink Model B (BMI-11) with the following stage dimensions:

Jet No.	Jet Dia., in.	Spacing of Jet Opening, in.
1	0.349	0.747
2	0.1775	0.533
3	0.1396	0.419
4	0.0946	0.302
5	0.0731	0.220

4. Emission Data Plots

   Plots of gaseous emissions of NO_x, HC, CO, and smoke as a function of excess O_2 at a given load are included.

5. Stack Traverse

   Plots of stack traverse data for O_2, velocity and temperature as a function of position in the stack are included.

6. Fuel Analysis

   Laboratory reports of fuel analysis are included as received.

Dash marks entered on the data forms indicate that data were not available. Blacked out areas on certain data forms are deletions of company names at which boiler tests were conducted.

INSTRUMENTATION

The emission measurements were made with instrumentation contained in a 2.5 by 9 meter (8 by 27 ft) laboratory trailer. The gaseous emission measurements, except sulfur oxides, were made with analysers located in the measurement console in the trailer. The particulate concentration, particulate size, and sulfur oxides concentration measurements were made with instrumentation prepared in the wet chemistry area of the laboratory and taken to the sample port. The weighing and titration were done in or near the laboratory.

The emission measurement instrumentation used for the program was that shown in Table 3. The operation of the instrumentation is discussed in detail in the contract final reports.

TABLE 3. EMISSION MEASUREMENT INSTRUMENTATION

Emission	Symbol	Measurement Method	Equipment Mfgr & Model
Nitric oxide	NO	Chemiluminescent*	Thermo Electron, 10A
Oxides of nitrogen	NO_x	Chemiluminescent*	Thermo Electron, 10A
Carbon monoxide	CO	Spectrometer*	Beckman, 864
Carbon dioxide	CO_2	Spectrometer*	Beckman, 865
Oxygen	O_2	Polarographic*	Teledyne, 326A
Hydrocarbons	HC	Flame ionization*	Beckman, 402
Sulfur dioxide and trioxide	SO_2, SO_3	Absorption/ titration	KVB Equipment Co.
Total particulate matter	PM	EPA Std. Method 5	Joy Mfg. Co.
Particulate size	--	Cascade impactor	Monsanto-Brink, B(BMS-11)
Smoke spot	R	Reflection	Research Appliance Co.
Opacity	--	EPA Std. Method 9	--

*Precision; ± 1% of Full Scale

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GLOSSARY OF SYMBOLS USED ON DATA FORMS

Burner Type

Air	Air Atomizer
Chirt	Chain Grate
Pulv.	Pulverizer
Ring	Natural Gas Ring
SpStk	Spreader Stoker
Spud	Natural Gas Gun
Steam	Steam Atomizer

Test Fuel

Coal	Coal
NG	Natural Gas
Ref.Gas	Refinery Gas
NG/#6	Mixture, NG and #6
#2	No. 2 Grade Fuel Oil
#5	No. 5 Grade Fuel Oil
#6	No. 6 Grade Fuel Oil
PS300	Pacific Standard Fuel Oil No. 300

Test Type

Air Reg	Air Register Adjustment
Atom Press	Burner Atomizing Pressure Adjustment
BOOS	Burners Out Of Service
Base	Baseline
BrTune	Boiler Tuneup
CombCyc	Combined Cycle
Damper	Air Damper Adjustment
HiAir	High Excess Air
HiLoad	High Load
LowAir	Low Excess Air
LowLoad	Low Load
LowNOx	Low NOx Condition
NrmlAir	Normal Excess Air
OFA	Overfire Air
SOA	Staged Combustion Air
SnglCyc	Single Cycle
SteamInjec	Steam Injection
VPH	Variable Combustion Air Temperature
Viscosity	Fuel Oil Viscosity

[illegible]

INDUSTRIAL BOILER DESIGN DATA

Location No. 1 Test No. 5 Unit No. 2

Unit Description B&W Integral Furnace Type FM

Installation Date	1964
Steam Output (10^3 lb/hr)	275
Design Pressure (psig)	800
Final Steam Temp (°F)	900
Furnace Type	Watertube
Furnace Size L-W-H (ft)	18 - 6 - 7
Furnace Area (ft^2)	535
Furnace Volume (ft^3)	765
Burner Description	1 B&W Ring & Steam Atom. Burn.
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Nat. Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 400

Comments:

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BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 1

Unit 2

Fuel Nat Gas

Test No.	5-1	5-2	5-3	5-4			
Test Type	Nl Air	Nl Air	Normal	Nl Air			
Test Load (10^3 lb/hr)	22.5	22.5	22.5	15.0			
Excess O_2 (%)	3.9	4.0	3.7	4.9			
NO_x (ppm) v	70	76	74	58			
NO (ppm) #	67	73	70	57			
CO_2 dry (%)	9.6	9.2	10.0	8.8			
CO (ppm) #	167	156	210	48			
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	80	77	77				
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	195	195	195	195			
Final Stm Temp. (°F)	480	480	480	480			
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.	Amb.			
Stack Temp. (°F)	502	505	500	502			
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.	Amb.	Amb.			
Fuel Pres. (psig)	0.62	0.68	0.61	0.48			
Furnace Pres. (in.H_2O)	0.15	0.15	0.10	0.14			
Register (% open)	100	100	100	100			

v @ 3% O_2 dry

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Emissions for Volumetric Additions as a Function of Burner Degree
δ_v, %
NOx, ppm
CO, ppm
NO, ppm
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FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	85.8	13.0	1108
5	.0	0	.1	85.8	13.0	1108
13	.0	0	.1	85.8	13.0	1108
14	.0	0	.1	85.8	13.0	1108
16	0	.8	6.8	74.0	80.8	1139
18	0	.3	6.8	74.0	80.8	1139
24	0	.9	6.7	74.0	80.8	1139
25	.0	0	.1	85.8	13.0	1108
30	0	.8	6.8	74.0	80.8	1139
37	.0	0	.1	85.8	13.0	1108
38	.0	0	.1	85.8	13.0	1108
32	.0	.8	0.1	88.9	3.4	984
40	.0	0	3.9	95.8	0	966
41	.0	0	.1	85.8	13.0	1108
47	.0	0	3.9	95.8	0	966
48	.0	.8	0.1	88.9	3.4	984
49	.0	0	0.4	84.1	8.7	967
56	.0	0	.1	85.8	13.0	1108
60	.0	0	.1	85.8	13.0	1108
67	.0	0	.1	85.8	13.0	1108
68	.0	0	.1	85.8	13.0	1108
76	0.8	0	1.3	88.8	88.7	1048
77	0.8	0	1.3	88.8	88.7	1048
88	0	.8	6.8	74.0	80.8	1139

INDUSTRIAL BOILER DESIGN DATA

Location No. 1 Test No. 12, 13 Unit No. 1

Unit Description B&W Integral Furnace Type PM

Installation Date	1964
Steam Output (10^3 lb/hr)	250
Design Pressure (psig)	300
Final Steam Temp (°F)	400
Furnace Type	Watertube
Furnace Size L-W-H (ft)	18 - 8 - 7
Furnace Area (ft^2)	836
Furnace Volume (ft^3)	765
Burner Description	1 B&W Ring & Steam Atomz. Burn.
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil, Nat Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	515 on Oil, 460 on gas

Comments:

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BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location /

Unit /

Fuel Nat. Gas

Test No.							
Test Type							
Test Load (10^3 lb/h)							
Excess O_2 (%)							
NO_x (ppm) #							
NO (ppm) #							
$(X)_2$ dry (%)							
CO (ppm) #							
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)		Amb.	Amb.	Amb.	Amb.	Amb.	Amb.
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

* @ 3% O_2 dry

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BOILER EMISSION MEASUREMENTS AND CONTROL BOOM DATA

Location #

Unit #

Fuel Nat. Gas

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm) #							
NO (ppm) #							
O_2 dry (%)							
CO (ppm) #							
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

@ 3% O_2 dry

EVB 6001-401

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 1

Unit 1

Fuel Nat Gas

Test No.							
Test Type							
Test Load (10^3 lb/h)							
Excess O_2 (%)							
NO_x (ppm) #							
NO (ppm) #							
$(S)_2$ dry (%)							
(S) (ppm) #							
NO (ppm) #							
NO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

@ 3% O_2 dry

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BOILER EMISSION MEASUREMENTS
AND CONTROL SYSTEM DATA

Location /

Unit /

Fuel Air/ Gas

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm) #							
NO (ppm) #							
CO_2 dry (%)							
CO (ppm) #							
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

EVB 6001-69

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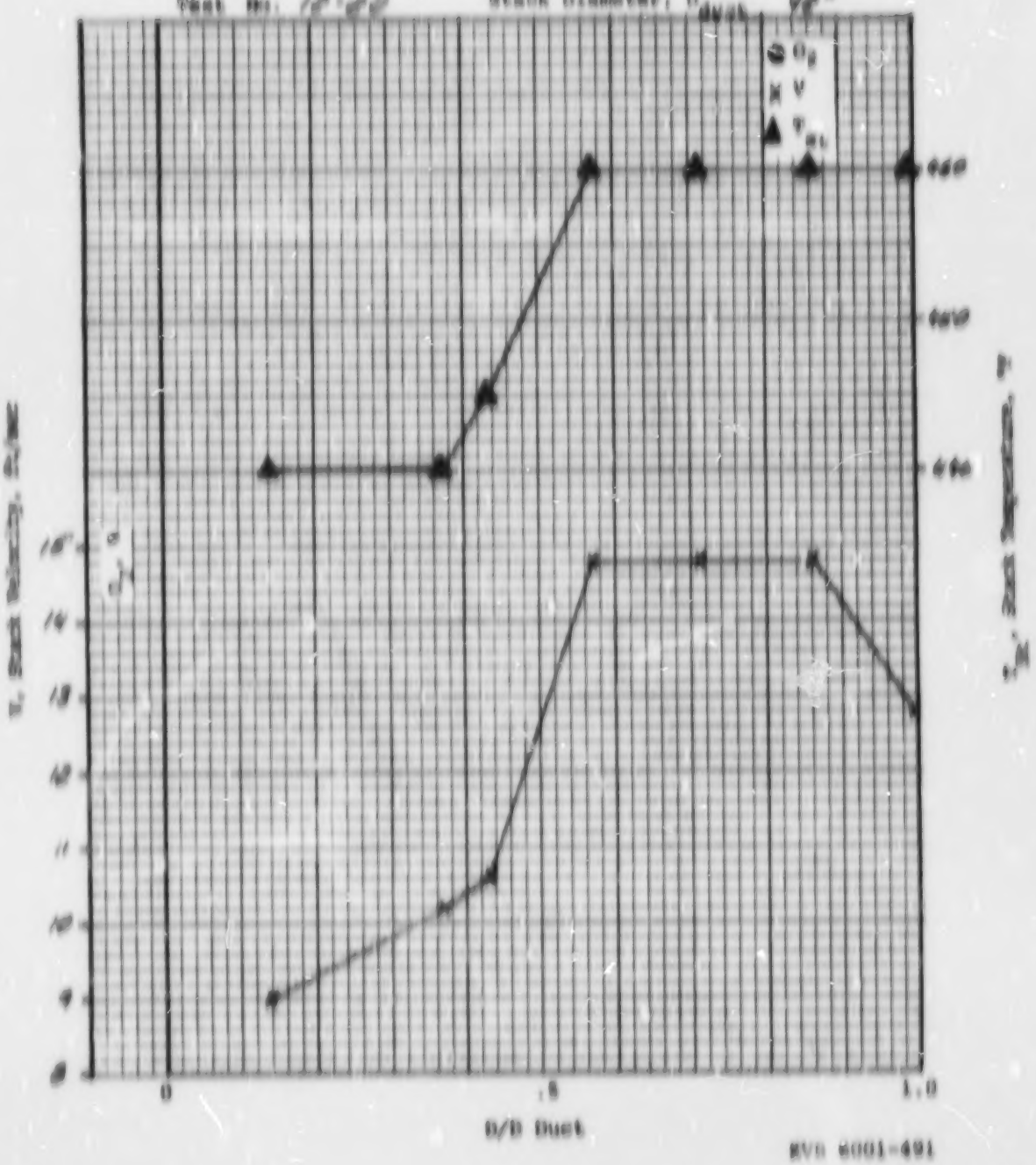
STACK TRAVERSE DATA

Location No. 1 Fuel NAT GAS

Unit No. 1 Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D [illegible] 96"

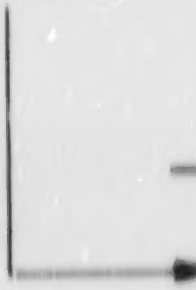


RVR 4001-491

Location 1
Unit 1
Test No. 12

FUEL ANALYSIS SUMMARY

Gas Fuel



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.9	0	.1	85.0	13.9	1100
5	.9	0	.1	85.0	13.9	1100
53	.9	0	.1	85.0	13.9	1100
13	.9	0	.1	85.0	13.9	1100
14	0	.9	6.0	74.0	99.6	1129
15	0	.9	6.0	74.0	99.6	1129
16	0	.9	6.0	74.0	99.6	1129
55	.9	0	.1	85.0	13.9	1100
19	0	.9	6.0	74.0	99.6	1129
57	.9	0	.1	85.0	13.9	1100
58	.9	0	.1	85.0	13.9	1100
59	.8	.9	6.1	90.9	9.0	956
60	.9	0	3.9	95.6	0	966
61	.9	0	.1	85.0	13.9	1100
67	.9	0	3.9	95.6	0	966
68	.8	.9	6.1	90.9	9.0	964
69	.9	0	0.4	94.1	6.7	997
65	.9	0	.1	85.0	13.9	1100
66	.9	0	.1	85.0	13.9	1100
67	.9	0	.1	85.0	13.9	1100
69	.9	0	.1	85.0	13.9	1100
76	0.9	0	5.9	33.5	99.7	1040
77	0.9	0	5.9	33.5	99.7	1040
80	0	.9	6.0	74.0	99.6	1129

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location /

Unit /

Fuel #2 oil

Test No.	6-2-1						
Test Type	Base						
Test Load (10^3 lb/hr)	40.5						
Excess O_2 (%)	4.0						
NO_x (ppm) a	148						
NO (ppm) a	138						
CO_2 dry (%)	13.8						
CO (ppm) a	5.0						
HC (ppm) a							
SO_x (ppm) a							
SO_2 (ppm) a							
Total Part. (lb/MBtu)							
Soll'd Part. (lb/MBtu)							
Boiler Efficiency (%)	77						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	2350						
Final Stm Temp. (°F)	670						
Combus. Air Temp. (°F)	Ambient						
Stack Temp. (°F)	315						
Fuel Flow							
Fuel Temp. (°F)	Ambient						
Fuel Pres. (psig)	100						
Furnace Pres. (in. H_2O)	0.05						
Register (% open)	Auto						

a @ 3% O_2 dry

EVB 6001-491

INDUSTRIAL BOILER DESIGN DATA

Location No. 1 Test No. 66, 67 Unit No. 3

Unit Description Nebraska Furnace, Model 20/495"

Installation Date	1970
Steam Output (10^3 lb/hr)	300
Design Pressure (psig)	300
Final Steam Temp (°F)	400
Furnace Type	Watertube
Furnace Size L-W-H (ft)	17.5 - 8
Furnace Area (ft^2)	512
Furnace Volume (ft^3)	640
Burner Description	1 Peabody Ring & Steam Atom. Brit.
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil; Nat Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	350
Stack Temp (°F)	286 to 305

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
NO_x (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
NO (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
CO (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
HC (ppm) #							
SO_x (ppm) #	[illegible]						
SO_2 (ppm) #	[illegible]						
Total Part. (lb/MBtu)	[illegible]						
Solid Part. (lb/MBtu)	[illegible]						
Boiler Efficiency (%)	[illegible]			[illegible]	[illegible]		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Flow (lbm/hr)					[illegible]		
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

[illegible]

EVR 6001-491

Barbarash Smoke No.

Solutions No. 1 Test 23,600 Btu
No. 2 Test 62 cu
No. 3 Test
No. 4

● ○ ▲ □ ×

Solutions for Industrial Boilers as a Function of Excess Oxygen

O_2, %

CO, ppm

NO, ppm

169-1009 BAR

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location /

Unit 3

Fuel Nat Gas

Test No.	07-1	07-2	07-4	07-5	07-6	07-7	
Test Type	Low Load	Nl Load	Base	Nl Air	Low Air	Base Air	
Test Load (10^3 lb/hr)	145	179.5	238.5	234.0	220.5	234.5	
Excess O_2 (%)	3.8	3.8	5.7	6.9	4.5	6.7	
NO_x (ppm) #	89	83	96	93	90	77	
NO (ppm) #	85	79	91	90	86	81	
O_2 dry (%)	4.7	4.8	6.9	6.0	4.2	6.3	
CO (ppm) #	0	0	0	0	0	0	
HC (ppm) #							
SO_x (ppm) #			5.2				
SO_2 (ppm) #			4.7				
Total Part. (lb/MBtu)			0.0050				
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		78			78	74	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	2150	2102	2250	2200	2220	2250	
Final Stm Temp. (°F)	996	991	991	990	990	990	
Combus. Air Temp. (°F)							
Stack Temp. (°F)	260	300	345	340	305	340	
Fuel Flow							
Fuel Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	
Fuel Pres. (psig)	4.8	4.7	5.6	5.6	5.0	5.0	
Furnace Pres. (in. H_2O)	0.4	0.4	0.5	0.4	0.3	0.5	
Register (% open)	80	80	80	80	80	80	

@ 3% O_2 dry

Bacharach Smoke No.

NO_x, ppm

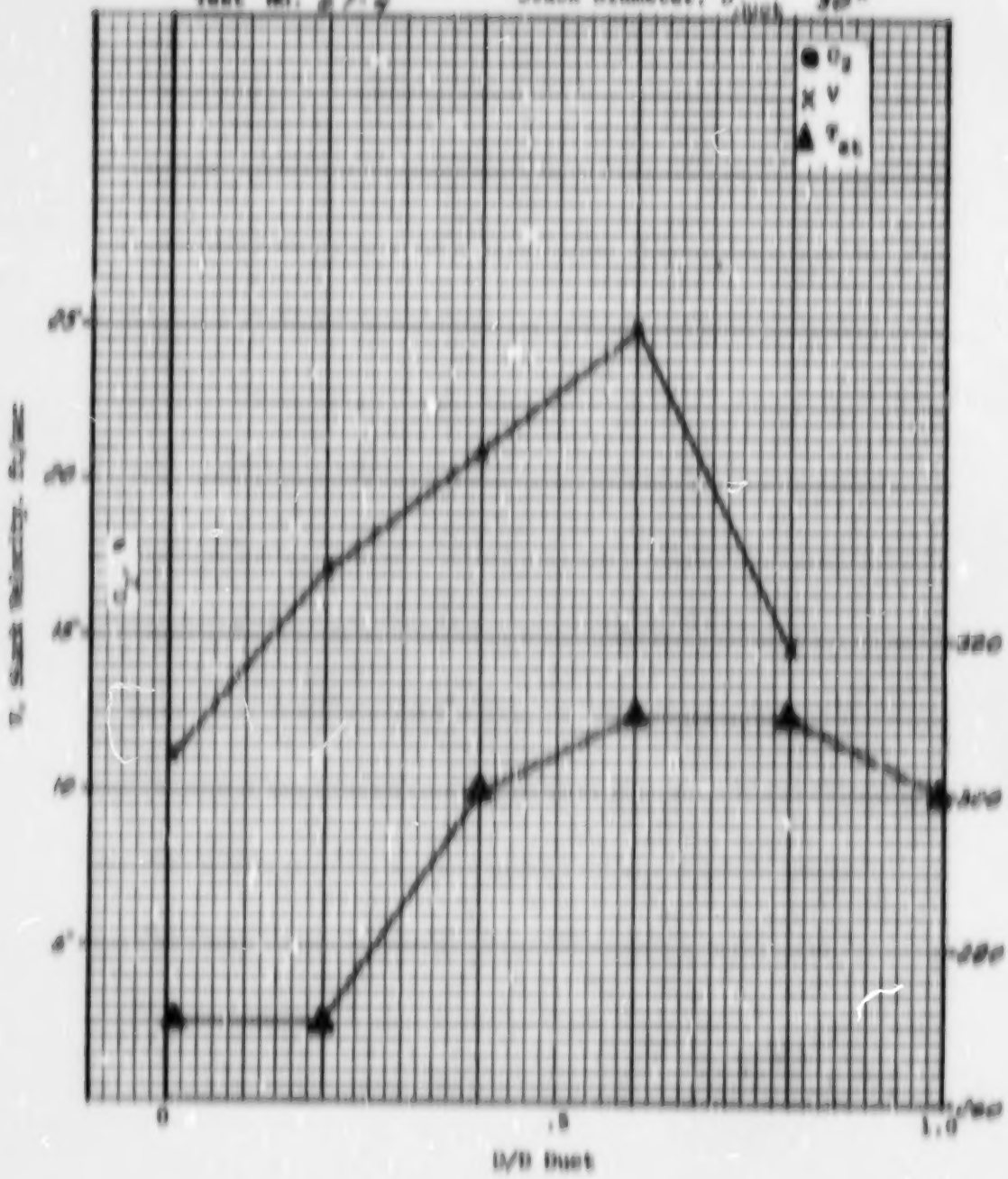
169-1009 GAS

STACK TRAVERSE DATA

Location No. 1 Fuel Nat Gas

Unit No. 3 Load 72500 lb/hr

Test No. 6-7-4 Stack Diameter, D 80" inch



RVB 6001-491

Location 1
Well B
Test No. 67

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.9	0	.1	85.0	13.9	1100
5	.9	0	.1	85.0	13.9	1100
13	.9	0	.1	85.0	13.9	1100
12	.9	0	.1	85.0	13.9	1100
14	0	.9	6.6	74.0	20.6	1139
15	0	.9	6.6	74.0	20.6	1139
24	0	.9	6.6	74.0	20.6	1139
25	.9	0	.1	85.0	13.9	1100
10	0	.9	6.6	74.0	20.6	1139
27	.9	0	.1	85.0	13.9	1100
28	.9	0	.1	85.0	13.9	1100
29	.6	.6	6.3	88.9	5.6	964
40	.1	0	3.9	95.6	0	965
41	.9	0	.1	85.0	13.9	1100
47	.1	0	3.9	97.6	0	966
48	.6	.6	6.3	88.9	5.6	964
49	.8	0	8.4	84.1	6.9	987
58	.9	0	.1	85.0	13.9	1100
60	.9	0	.1	85.0	13.9	1100
67	.9	0	.1	85.0	13.9	1100
68	.9	0	.1	85.0	13.9	1100
76	2.6	0	1.3	33.6	69.7	1060
77	2.6	0	1.3	33.6	69.7	1060
86	0	.9	6.6	74.0	20.6	1139

DUPLICATE
REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 : 225-1565
CABLE: TRUELABS

CLIENT: EVS Engineering
17332 Irvine Blvd.
Tustin, California 92680
Attn: Glenn Cate

DATE: February 27, 1974

RECEIVED: February 8, 1974

SAMPLE: 1 Fuel Oil - "Special Oil" Feb. 8, 1974

LABORATORY NO. 120981

P.O. No. 1700-43

INVESTIGATION: Analyses as requested.

Location 1
Unit 1 of 3
Test #2, #6

RESULTS

Gravity API @ 20°C	21.1
Viscosity @ 40°C, SSU	106
Flash Point, °C	107
Carbon Residue, Conradson, %	0.071
Aniline Point, °C	*
Distillation:	
Initial Boiling Point, °C	199
10%, °C	241
50%, °C	279
90%, °C	338
End Point, °C	372
Recovery, %	98
Carbon, %	85.94
Hydrogen, %	12.72
Nitrogen, %	0.065
Sulfur, %	0.40
Ash, %	0.003
Gross Heat of Combustion, BTU/lb.	19,440
Net Heat of Combustion, BTU/lb.	18,280

* The sample was too dark for determining the Aniline Point by the conventional method described in ASTM-D611.

(continued)

DUPLICATE

TRUESDAIL LABORATORIES, INC. Page 1

location 1 Unit 1 #3 Test 60, 66

The results of the spectrographic analysis are as follows:

	Parts Per Million in Oil
Copper	2.2
Zinc	4.5
Iron	5.1
Tin	1.3
Boron	0.018
Silicon	0.69
Manganese	0.11
Magnesium	0.69
Lead	1.4
Vanadium	0.99
Nickel	1.9
Aluminum	0.18
Calcium	1.2
Titanium	0.069
Silver	0.011
Cobalt	0.060
Strontium	trace
Chromium	0.036

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Alvin E. Hay

Alvin E. Hay
Director of Laboratories

RVR 6001-491

INDUSTRIAL BOILER DESIGN DATA

Location No. 1 Test No. NV Horse #25 Unit No. 2

Unit Description B&W Integral Furnace type FM

Installation Date	1964
Steam Output (10^3 lb/hr)	290
Design Pressure (psig)	300
Final Steam Temp (°F)	600
Furnace Type	Waterwalls
Furnace Size L-W-H (ft)	18 - 6 - 7
Furnace Area (ft^2)	536
Furnace Volume (ft^3)	756
Burner Description	1 B&W Ring of Steam atom. Burn.
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil, Natl. Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	515 to 560

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 1

Unit #

Fuel Nat. Gas

Test No.	101-1	101-2	101-3	101-4	101-5	101-6	
Test Type	Lo Excess Air	Lo Excess Air	Hi Air	Hi Air	Hi Air	Hi Air	
Test Load (10^3 lb/hr)	94.5	120	120	120	120	120	
Excess O_2 (%)	1.6	2.2	4.9	4.4	4.0	4.2	
NO_x (ppm) #	77	78	80	74	82	82	
NO (ppm) #	73	74	76	70	78	80	
CO_2 dry (%)	11	10.8	9.2	8.2	9.6	9.4	
CO (ppm) #	69	67	10	0	10	15	
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		79					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	230	230	230	230	230	230	
Final Stm Temp. (°F)	394	394	394	394	394	394	
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	
Stack Temp. (°F)	580	576	570	560	575	582	
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	
Fuel Pres. (psig)	0.32	0.36	0.34	0.34	0.34	0.34	
Furnace Pres. (in. H_2O)	0.1	0.1	0.05	0.3	0.1	0.17	
Register (% open)	100	100	100	100	100	100	

4 @ 3% O2 only

FUEL ANALYSIS SUMMARY

Gas Fuel

Location 1
Unit 2
Test No. 101

Test No.	Type of Gas	CH_4	C_2H_6 C_1-%	C_3H_8 C_2H_6-%	C_4H_{10} C_3H_8-%	C_5H_{12}	C_6H_{14}	H_2	CO_2	O_2	N_2	H_2O	Higher Heating Value (HHV)		Lower Heating Value (LHV)	
		%	%	%	%	%	%	%	%	%	%	%	Btu/ft³	Btu/lb	Btu/ft³	Btu/lb
101	Nat.	96.52	1.26	0.20	0.062	0.033	0.032	–	0.75	0.12	0.37	0.65	1,035	23,407	933	21,092
102-105	Nat.	96.52	1.26	0.20	0.062	0.033	0.032	–	0.75	0.12	0.37	0.65	1,035	23,407	933	21,092
106-110	Nat.	95.80	2.01	0.40	Trace	–	–	–	0.10	–	0.60	–	1,046	23,653	943	21,319
111-115	Nat.	95.31	1.31	0.60	0.15	0.04	0.02	–	0.67	–	1.06	0.24	1,035	23,407	933	21,092
116-120	Nat.	95.31	1.31	0.60	0.15	0.04	0.02	–	0.67	–	1.06	0.24	1,035	23,407	933	21,092
121-125	Nat.	97.0	0.84	0.31	0.08	0.01	0.01	–	–	–	–	–	1,029	23,268	928	20,979
126-130	Nat.	96.40	1.10	1.10	0.40	0.10	–	0.02	1.40	–	1.40	–	1,035	23,407	933	21,092
131-135	Nat.	97.30	1.37	0.71	–	–	–	0.22	0.74	–	–	–	1,031	23,316	929	21,001
136-140	Nat.	96.90	1.90	0.10	0.06	0.02	–	–	0.60	–	0.30	–	1,035	23,407	933	21,092
141-145	Nat.	97.26	1.60	0.0077	0.08	–	–	–	0.37	0.01	0.30	–	1,035	23,407	933	21,092
146-150	Nat.+ Fuel	48.40	30.90	1.60	0.10	0.02	–	16.47	–	0.02	2.40	–	1,376	23,255	1,211	20,470

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location /

Unit 2

Fuel #2 Oil

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test Type	[illegible] Air	[illegible] Air	Low Air	Good Air	Hi Air	[illegible] Air	
Test Load (10^3 lb/hr)	140	140	140	140	140	190	
Excess O_2 (%)	5.2	3.2	7.8	5.1	9.8	5.3	
NO_x (ppm) #	87	106	100	92	103	90	
NO (ppm) #	83	101	95	88	98	86	
O_2 dry (%)	4.0	3.0	3.4	4.2	3.1	4.6	
CO (ppm) #	100	42	60	108	62	108	
HC (ppm) #							
SO_x (ppm) #						241	
SO_2 (ppm) #						226	
Total Part. (lb/MBtu)						0.029	
Solid Part. (lb/MBtu)						0.019	
Boiler Efficiency (%)						80	
Smoke Spot No.							
Opacity (%)						0	
Final Stm Pres. (psig)	235	235	235	235	235	235	
Final Stm Temp. (°F)	396	396	396	396	396	396	
Combus. Air Temp. (°F)							
Stack Temp. (°F)	530	510	520	500	540	550	
Fuel Flow							
Fuel Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	
Fuel Pres. (psig)	40	28	28	28	28	40	
Furnace Pres. (in. H_2O)	0.15	0.12	0.1	0.10	0.4	0.05	
Register (% open)	100	100	100	100	100	100	

[illegible]

Bachharach Smoke No.
NO, ppm
CO, ppm
NO, ppm
Relative Air Deficiency, Percent or Excess Air
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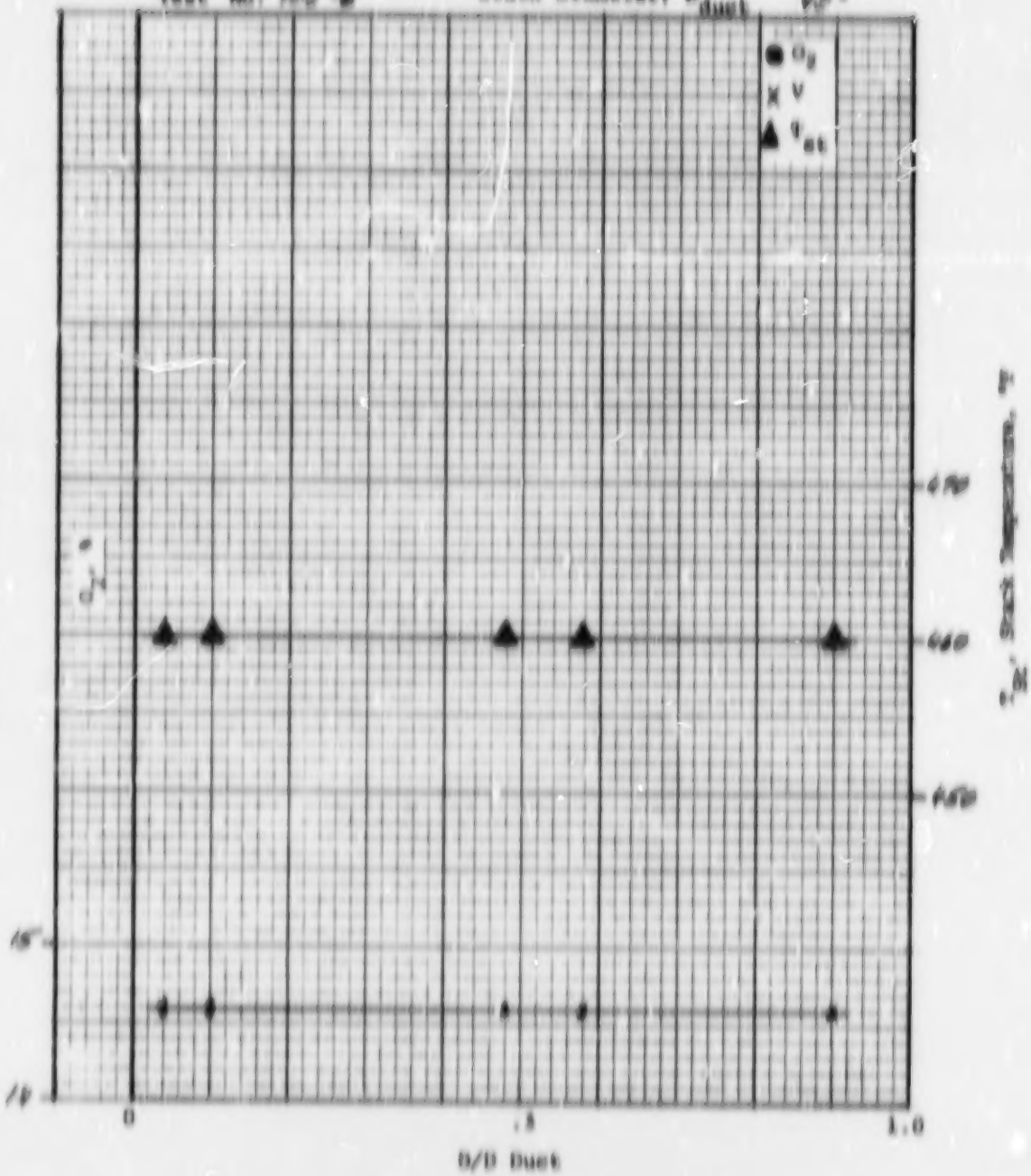
STACK TRAVERSE DATA

Location No. 1 Fuel #2 Oil

Unit No. 2 Load 15, 000 lb/hr

Test No. 1012-6 Stack Diameter, D_{duct} 96"



BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location *1*

Unit *#2*

Fuel *#2 Oil*

Test No.	*#2-1*						
Test Type	*Normal Air*						
Test Load (10^3 lb/hr)	*150*						
Excess O_2 (%)	*4.2*						
NO_x (ppm) #	*84*						
NO (ppm) #	*80*						
CO_2 dry (%)	*11.2*						
CO (ppm) #	*170*						
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	*81*						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	*236*						
Final Stm Temp. (°F)	*1?6*						
Combus. Air Temp. (°F)	*Amb*						
Stack Temp. (°F)	*560*						
Fuel Flow							
Fuel Temp. (°F)	*Amb*						
Fuel Pres. (psig)	*40*						
Furnace Pres. (in. H_2O)	*0.12*						
Register (% open)	*100*						

@ *3%* O_2 *dry*

INDUSTRIAL BOILER DESIGN DATA

Location No. 1 Test No. 104 thru 108 Unit No. 1

Unit Description B&W Integral Furnace Type FM

Installation Date	1964
Steam Output (10^3 lb/hr)	290
Design Pressure (psig)	300
Final Steam Temp (°F)	490
Furnace Type	Watertube
Furnace Size L-W-H (ft)	18 - 6 - ?
Furnace Area (ft^2)	936"
Furnace Volume (ft^3)	765"
Burner Description	1 B&W Ring of steam atom. type
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil, Nat. Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	450 to 500

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location /

Unit /

Fuel Natural Gas

Test No.	104-1		105-1	105-2		106-1	106-2
Test Type	Normal Air		Normal Air	Normal Air		Normal Air	Normal Air
Test Load (10^3 lb/hr)	240		240	240		240	180
Excess O_2 (%)	1.9		1.8	1.9		2.0	2.5
NO_x (ppm) a	75		80	82		82	84
NO (ppm) c	71		76	78		78	80
CO_2 dry (%)	11.2		10.9	10.4		10.4	10.1
CO (ppm) a	44.5		0	0		0	0
HC (ppm) a							
SO_x (ppm) a							
SO_2 (ppm) a							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	81		81			80	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	235		235	235		235	235
Final Stm Temp. (°F)	396		396	396		396	396
Combus. Air Temp. (°F)	Amb.		Amb.	Amb.		Amb.	Amb.
Stack Temp. (°F)	580		580	570		570	630
Fuel Flow							
Fuel Temp. (°F)	Amb.		Amb.	Amb.		Amb.	Amb.
Fuel Pres. (psig)	10.0		10.0	10.1		170	9.8
Furnace Pres. (in.H_2O)	0.12		0.12	0.15		0.15	0.070
Register (% open)	100		100	100		100	100

a lb NO_2/10^6 Btu

BOILER EMISSION MEASUREMENTS
AND COMBUSTION DATA

Location /

Unit /

Fuel #2 Oil

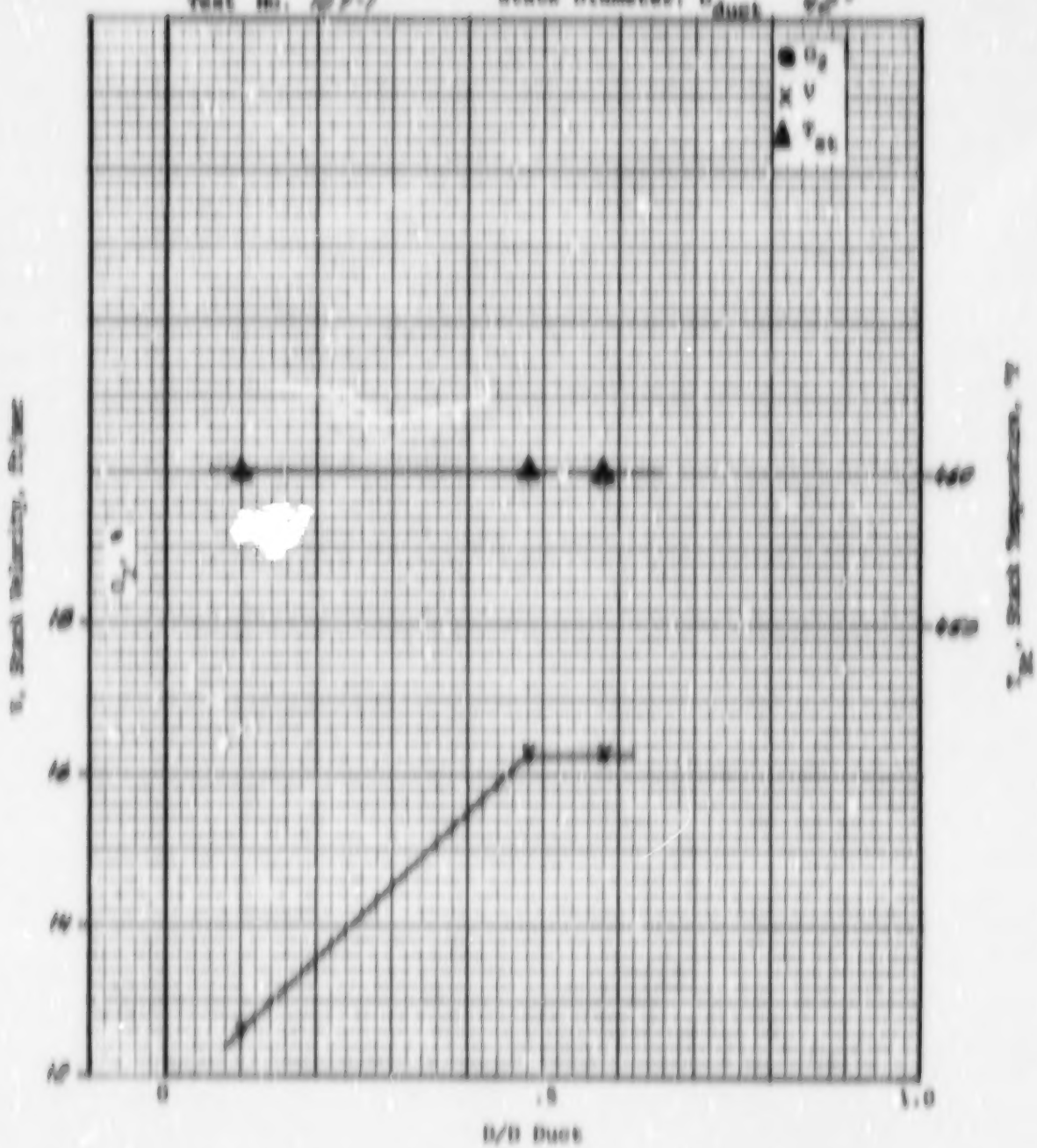
Test No.	207-1	207-2	207-3	207-4	207-5		
Test Type	Normal Air	Normal Air	Normal Air	Hi Air	Hi Air		
Test Load (10^3 lb/hr)	238	246	180	180	180		
Excess O_2 (%)	3.1	3.7	4.6	5.9	5.2		
NO_x (ppm) #	79	85	90	97	96		
NO (ppm) #	75	81	88	93	91		
CO_2 dry (%)	12.9	12.2	11.7	10.6	10.9		
CO (ppm) #	120	114	196	119	193		
HC (ppm) #							
SO_x (ppm) #	384						
SO_2 (ppm) #	371						
Total Part. (lb/MBtu)	0.018						
Solid Part. (lb/MBtu)	0.011						
Boiler Efficiency (%)		83					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	230	235	235	234	234		
Final Stm Temp. (°F)	396	396	396	396	396		
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.		
Stack Temp. (°F)	600	580	560	560	560		
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.		
Fuel Pres. (psig)	63	64	58	58	58		
Furnace Pres. (in. H_2O)	0.17	0.16	0.1	0.13	0.11		
Register (% open)	100	100	100	100	100		

@ 3% O_2 dry

STACK TRAVERSE DATA

Location No. /
Unit No. /
Test No. [illegible]

Fuel [illegible]
Load [illegible] lb/hr
Stack Diameter, D_{duct} [illegible]"



BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 1

Unit 1

Fuel #2 Oil

Test No.	100-1	100-2	100-3				
Test Type	lb/mil Air	lb/mil Air	lb/mil Air				
Test Load (10^3 lb/hr)	175	200	200				
Excess O_2 (%)	3.9	3.6	3.8				
NO_x (ppm) #	80	84	86				
NO (ppm) #	75	80	82				
CO_2 dry (%)	12.9	12.6	12.5				
CO (ppm) #	150	170	120				
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)			0.045				
Solid Part. (lb/MBtu)			0.028				
Boiler Efficiency (%)			83				
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	235	230	235				
Final Stm Temp. (°F)	490	490	490				
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.				
Stack Temp. (°F)	540	585	590				
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.	Amb.				
Fuel Pres. (psig)	39	55	55				
Furnace Pres. (in. H_2O)	0.075	0.19	0.00				
Register (% open)	100	100	100				

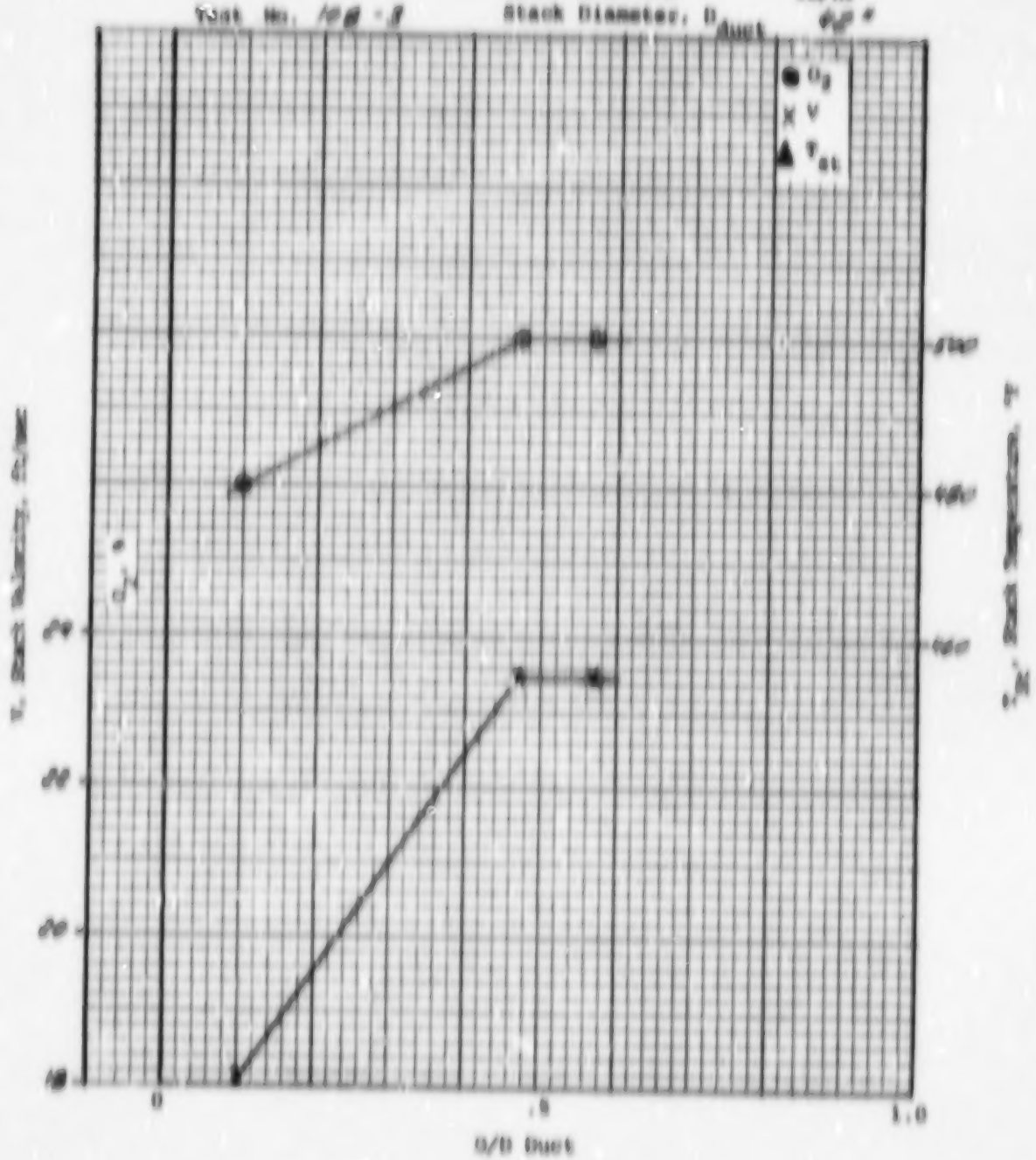
3% O2 dry

STACK TRAVERSE DATA

Location No. 1
Unit No. 1
Test No. 100 - B

Fuel #2 Oil
Load 60,000
Stack Diameter, D_{duct}

lb/hr
#2 *



REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 : 225-1341
CABLE: TRUELAB

CLIENT: KVB Engineering
17332 Irvine Blvd.
Tustin, California 92680
Attn: Glenn Cate

DATE: February 27, 1974

RECEIVED: February 9, 1974

SAMPLE: 1 Fuel Oil - "Special Oil" Feb. 6, 1974

LABORATORY NO. 120921

P.O. No. 1700-43

INVESTIGATION: Analyses as requested.

Location 1
Unit 1 & 2
Test 102, 103, 107, 108.

RESULTS

Gravity API @ 30°C	31.1
Viscosity @ 40°C, SSU	106
Flash Point, °C	107
Carbon Residue, Conradson, %	0.071
Aniline Point, °C	*
Distillation:	
Initial Boiling Point, °C	193
10%, °C	241
50%, °C	279
90%, °C	333
End Point, °C	372
Recovery, %	98
Carbon, %	85.94
Hydrogen, %	12.73
Nitrogen, %	0.045
Sulfur, %	0.40
Ash, %	0.003
Gross Heat of Combustion, BTU/lb.	19,440
Net Heat of Combustion, BTU/lb.	18,280

* The sample was too dark for determining the Aniline Point by the conventional method described in ASTM-D611.

(continued)

Lab. 1 Unit 1 of 2 Test 101, 102, 103, 104

The results of the spectrographic analysis are as follows:

	Parts Per Million in Oil
Copper	2.2
Zinc	4.5
Iron	5.1
Tin	1.3
Boron	0.018
Silicon	0.69
Manganese	0.11
Magnesium	0.69
Lead	1.4
Vanadium	0.09
Nickel	1.5
Aluminum	0.18
Calcium	1.2
Titanium	0.069
Silver	0.011
Cobalt	0.060
Strontium	trace
Chromium	0.084

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Alvin E. May

Alvin E. May
Director of Laboratories

INDUSTRIAL BOILER DESIGN DATA

Location No. 2	Test No. 19, 65	Unit No. 2
Unit Description	B&W Field Erected Boiler Type P-1007	

Installation Date	1960
Steam Output (10^3 lb/hr)	570
Design Pressure (psig)	1450
Final Steam Temp (°F)	750
Furnace Type	Waterwalls
Furnace Size L-W-H (ft)	40 - 26 - 60
Furnace Area (ft^2)	1040
Furnace Volume (ft^3)	3400
Burner Description	6 Coen Ring 4 steam atom. Burners
Horiz. Burner Spacing (ft)	3.33
Vert. Burner Spacing (ft)	2.33
Test Fuel	Nat. Gas & #6 Oil
Fuel Temp at Burner (°F)	Amb. for N.G., 180 for #6 Oil
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~390 on N.G., ~480 on #6 Oil

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location #

Unit #

Fuel Natural Gas

Test No.	18-1	18-2	18-3	18-4	18-5	18-6	18-7
Test Type	Normal Air	Hi Air	Hi Air	Hi Air	Normal Air	Hi Excess	Normal Air
Test Load (10^3 lb/hr)	475	475	475	475	570	68	82
Excess O_2 (%)	2.6	5.1	4.0	3.0	1.1	6.4	2.2
NO_x (ppm) #	136	136	132	121	111	126	104
NO (ppm) #	118	116	113	104	82	112	99
CO_2 dry (%)	10.0	8.4	9.6	9.9	10.0	10.1	10.1
CO (ppm) #	698	0	183	1048	>2000	>2000	>2000
HC (ppm) #	32	28	35	32	27	30	28
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	78		78	77			
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	151	150	151	151	148	150	152
Final Stm Temp. (°F)	350	350	350	350	350	350	350
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.
Stack Temp. (°F)	580	608	594	591	618	603	608
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.
Fuel Pres. (psig)	1.4	1.4	1.4	1.4	2.2	2.2	1.88
Furnace Pres. (in.H_2O)	-0.14	-0.23	-0.19	-0.16	-0.12	-0.28	-0.17
Register (% open)	#1 Oil 30 Gas 100	#1 Oil 30 Gas 100	#1 Oil 30 Gas 100	#1 Oil 30 Gas 100	#1 Oil 30 Gas 100	#1 Oil 30 Gas 100	#1 Oil 30 Gas 100

@ 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL NOX DATA

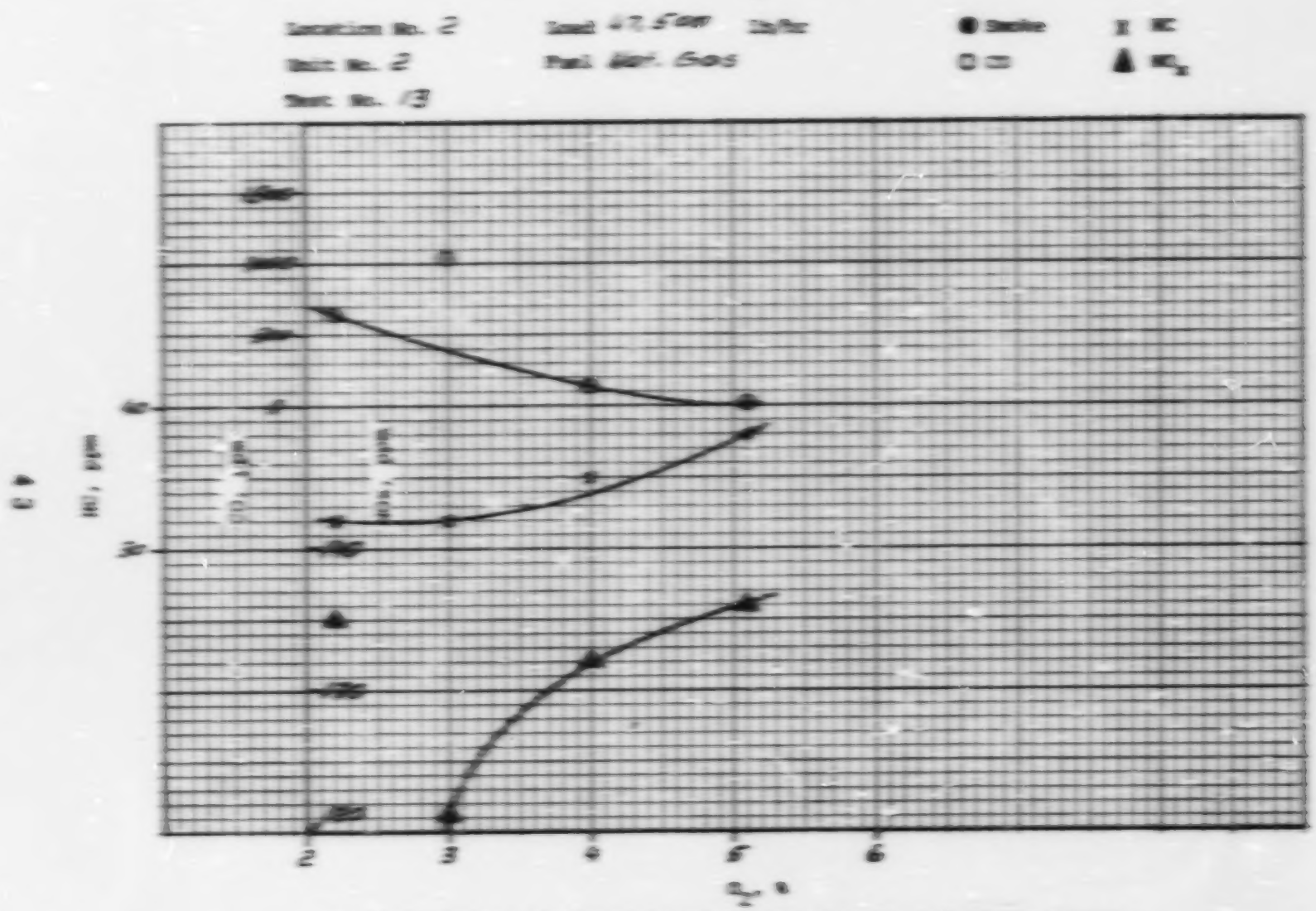
Location #

Unit #

Fuel #6 oil / gas

Test No.	12-8	12-9	12-10				
Test Type	Normal Air	Normal Air	Normal Air				
Test Load (10^3 lb/hr)	336	300	25				
Excess O_2 (%)	6.8	8.6	11.0				
NO_x (ppm) *	131	139	136				
NO (ppm) *	113	127	150				
$(O)_2$ dry (%)	7.8	8.6	8.4				
CO (ppm) *	73	80	100				
HC (ppm) *	65	68	64				
SO_x (ppm) *	----	----	----				
SO_2 (ppm) *	----	----	----				
Total Part. (lb/MBtu)	----	----	----				
Solid Part. (lb/MBtu)	----	----	----				
Boiler Efficiency (%)	----	----	78				
Smoke Spot No.	----	----	----				
Opacity (%)	----	----	----				
Final Stm Pres. (psig)	196	145	100				
Final Stm Temp. (°F)	368	368	368				
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.				
Stack Temp. (°F)	470	525	510				
Fuel Flow	----	----	----				
Fuel Temp. (°F)	Amb.	Amb.	Amb.				
Fuel Pres. (psig)	.7	.4	.04				
Furnace Pres. (in. H_2O)	-0.28	-0.12	-0.16				
Register (% open)	#1 30 #2 100	#1 30 #2 100	#1 30 #2 100				

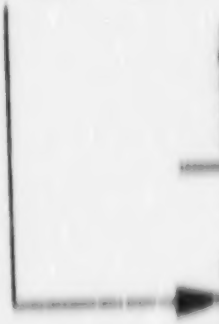
* @ 3% O_2 dry


2
3
4
5
6

Composition of liquid of Test No. 18

FUEL ANALYSIS SUMMARY

Gas Fuel



4	.0	0	.1	85.0	10.0	1100
5	.0	0	.1	85.0	10.0	1100
14	.0	0	.1	85.0	10.0	1100
15	.0	0	.1	85.0	10.0	1100
16	0	.0	6.0	74.0	20.0	1100
15	0	.0	6.0	74.0	20.0	1100
24	0	.0	6.0	74.0	20.0	1100
25	.0	0	.1	85.0	10.0	1100
26	0	.0	6.0	74.0	20.0	1100
37	.0	0	.1	85.0	10.0	1100
38	.0	0	.1	85.0	10.0	1100
39	.0	.0	6.0	88.0	5.0	984
40	.0	0	3.0	85.0	0	984
41	.0	0	.1	85.0	10.0	1100
47	.0	0	3.0	85.0	0	980
48	.0	0	6.0	88.0	5.0	984
49	.0	0	8.0	84.1	8.7	987
56	.0	0	.1	85.0	10.0	1100
58	.0	0	.1	85.0	10.0	1100
57	.0	0	.1	85.0	10.0	1100
59	.0	0	.1	85.0	10.0	1100
75	0.0	0	1.0	83.0	89.7	1060
77	0.0	0	1.0	83.0	88.7	1060
88	0	.0	6.0	74.0	20.0	1100

BOILER EMISSION MEASUREMENTS AND CONTROL BOOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(O)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

@ 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL RUN DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(O)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_3 (ppm) #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow gal/hr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location: [illegible]

Unit #: [illegible]

Fuel: [illegible]

Test No.						
Test Type						
Test Load (10^3 lb/hr)						
Excess O_2 (%)						
NO_x (ppm) #						
NO (ppm) #						
CO_2 dry (%)						
CO (ppm) #						
HC (ppm) #						
SO_x (ppm) #						
SO_2 (ppm) #						
Total Part. (lb/MBtu)						
Solid Part. (lb/MBtu)						
Boiler Efficiency (%)						
Smoke Spot No.						
Opacity (%)						
Final Stm Pres. (psig)						
Final Stm Temp. (°F)						
Combus. Air Temp. (°F)						
Stack Temp. (°F)						
Fuel Flow [illegible]						
Fuel Temp. (°F)						
Fuel Pres. (psig)						
Furnace Pres. (in. H_2O)						
Register (% open)						

[illegible]

Backreach Centre No.

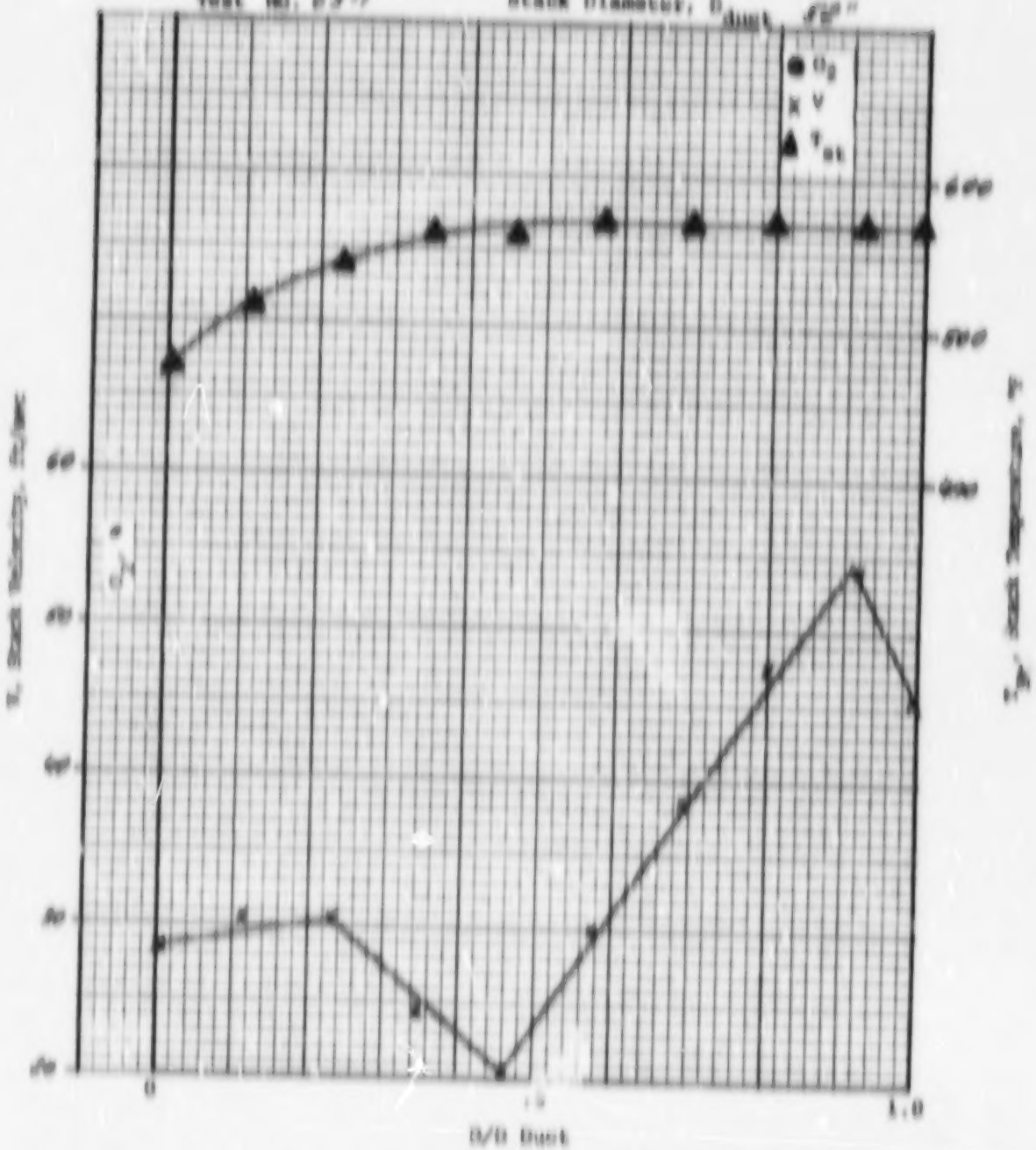
40

STACK TRAVERSE DATA

Location No. 2
Unit No. 2
Test No. 85-1

Fuel #6 Gas
Load 92 MW
Stack Diameter, D_duct 42"

lb/hr



INDUSTRIAL BOILER DESIGN DATA

Location No. 2 Test No. 68, 69 Unit No. 6

Unit Description B&W Field Erected Boiler Type FF2976

Installation Date	1968
Steam Output (10^3 lb/hr)	66.0
Design Pressure (psig)	150
Final Steam Temp (°F)	358
Furnace Type	Waterfloor
Furnace Size L-W-H (ft)	18 · 18 · 42
Furnace Area (ft^2)	1962
Furnace Volume (ft^3)	3900
Burner Description	6 Corner Ring of Steam atom. Burners
Horiz. Burner Spacing (ft)	3.33
Vert. Burner Spacing (ft)	2.33
Test Fuel	Nat. Gas & Fo 500
Fuel Temp at Burner (°F)	Amb. for N.G., 130 for Fo 500
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 570

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm) *	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm) *	[illegible]						
$(O)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm) *	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm) *							
SO_x (ppm) *	[illegible]						
SO_2 (ppm) *	[illegible]						
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		[illegible]	[illegible]		[illegible]		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* [illegible]

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm) #							
NO (ppm) #							
CO_2 dry (%)							
CO (ppm) #							
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

@ [illegible] % O2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location J

Unit 4

Fuel FS 300

Test No.	08:16	08:16	08:19	08:18	08:19	08:20	08:21
Test Type	24 Hours	24 Hours	24 Hours	24 Hours	24 Hours	24 Hours	24 Hours
Test Load (10^3 lb/hr)	370.5	91	30	32	92	96	87
Excess O_2 (%)	5.8	8.8	9.8	10.5	7.8	7.0	5.6
NO_x (ppm) #	991	896	962	982	982	976	992
NO (ppm) #	968						
CO_2 dry (%)	11.0	8.8	7.8	9.2	9.6	10.0	11.2
CO (ppm) #	0	0	0	0	0	0	0
HC (ppm) #		229	137	127	110	80	90
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							79
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1497	1495	1490	1492	1499	1495	1497
Final Stm Temp. (°F)	998	998	999	996	998	998	998
Combus. Air Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	Amb
Stack Temp. (°F)	580	555	535	520	500	505	502
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)	85	86	89	96	88	87	98
Furnace Pres. (in. H_2O)	-0.06	-0.19	-0.17	-0.18	-0.8	-0.21	-0.21
Register (% open)							

* @ 3% O2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 8

Unit 4

Fuel FS 800

Test No.	80-22						
Test Type	NN/SH Air						
Test Load (10^3 lb/hr)	51.8						
Excess O_2 (%)	5.6						
NO_x (ppm) #	492						
NO (ppm) #							
$(O)_2$ dry (%)	11.2						
CO (ppm) #	0						
HC (ppm) #	50						
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	900						
Final Stm Temp. (°F)	890						
Combus. Air Temp. (°F)	300						
Stack Temp. (°F)	621						
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)	60						
Furnace Pres. (in. H_2O)	-0.17						
Register (% open)	100						

@ 8% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 2

Unit 4

Fuel Natural Gas

Test No.	07-1	07-2	07-3				
Test Type	Base	Excess Air	Excess Air				
Test Load (10^3 lb/hr)	52	52	52				
Excess O_2 (%)	3.0	5.0	4.5				
NO_x (ppm) #	101	86	83				
NO (ppm) #		82					
$(SO_x)_2$ dry (%)	9.9	10.0	9.9				
CO (ppm) #	102	905	22				
HC (ppm) #							
$(SO_x)_2$ (lb/MBtu) #							
$(SO_x)_2$ (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	149	148	149				
Final Stm Temp. (°F)	348	348	348				
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.				
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)	3.0	3.0	3.0				
Furnace Pres. (in. H_2O)	-0.10	-0.10	-0.0				
Register (% open)	#1 12" #2 10"	#1 12" #2 10"	#1 12" #2 10"				

#1 was burner was out of service
#2 was air only

Continuation of Unit 4
Page No. 69

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	00.0	10.0	1150
5	.0	0	.1	00.0	10.0	1150
12	.0	0	.1	00.0	10.0	1150
13	.0	0	.1	00.0	10.0	1150
14	0	.0	0.0	74.0	00.0	1139
15	0	.0	0.0	74.0	00.0	1139
24	0	.0	0.0	74.0	00.0	1139
25	.0	0	.1	00.0	10.0	1150
30	0	.0	0.0	74.0	00.0	1139
37	.0	0	.1	00.0	10.0	1150
38	.0	0	.1	00.0	10.0	1150
39	.0	.0	0.0	00.0	0.0	904
40	.0	0	0.0	00.0	0	900
41	.0	0	.1	00.0	10.0	1150
47	.0	0	0.0	00.0	0	900
48	.0	0	0.0	00.0	0.0	904
49	.0	0	0.0	00.1	0.7	907
50	.0	0	.1	00.0	10.0	1150
60	.0	0	.1	00.0	10.0	1150
67	.0	0	.1	00.0	10.0	1150
69	.0	0	.1	00.0	10.0	1150
70	0.0	0	1.0	00.0	00.7	1060
77	0.0	0	1.0	00.0	00.7	1060
80	0	.0	0.0	74.0	00.0	1139

INDUSTRIAL BOILER DESIGN DATA

Location No. 17 Test No. 70 Unit No. 6

Unit Description B&W shop erected boiler Model FM
Burner Model CDE

Installation Date	1970
Steam Output (10^3 lb/hr)	125.0
Design Pressure (psig)	265
Final Steam Temp (°F)	600
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	15'-8"-12
Furnace Area (ft^2)	792
Furnace Volume (ft^3)	1900
Burner Description	1 B&W Ring of steamer natural gas
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 300
Fuel Temp at Burner (°F)	170
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	600

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location _____

Unit _____

Fuel _____

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm) #							
NO (ppm) #							
$(O)_2$ dry (%)							
CO (ppm) #							
HC (ppm) #							
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MMBtu)							
Solid Part. (lb/MMBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

to the O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL NOX DATA

Location #
Unit #
Fuel #6 #00

Test No.	PO-9	PO-10	PO-11	PO-12	PO-13	PO-14	PO-15
Test Type	Low Air	Air Reg.	40/60 Air	Low Load	Low Load	60/40 Air	60/40 Air
Test Load (10^3 lb/hr)	100	100	100	44	57	88.5	86
Excess O_2 (%)	5.7	7.4	8.0	9.0	8.5	4.8	5.3
NO_x (ppm) #	357	405	388	192	190	164	419
NO (ppm) #	340	386	365				
CO_2 dry (%)	11.1	10.4	10.4	8.2	10.0	11.4	11.4
CO (ppm) #				90	153	155	245
HC (ppm) #				112	67	93	36
SO_4 (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MMBtu)							
Solid Part. (lb/MMBtu)							
Boiler Efficiency (%)		78					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	147	140	143	140	140	142	143
Final Stm Temp. (°F)	348	348	348	344	344	344	344
Combus. Air Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	Amb
Stack Temp. (°F)	680	700	690	510	540	580	670
Fuel Flow							
Fuel Temp. (°F)	118	100	100	157	103	100	100
Fuel Pres. (psig)	70	71	70	68	68	68	68
Furnace Pres. (in. H_2O)	.1	.08	.1	.1	.1	.08	.1
Register (% open)	50	100	50	40	40	40	40

* Fo #6 oil

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location d

Unit 6

Fuel PA 300

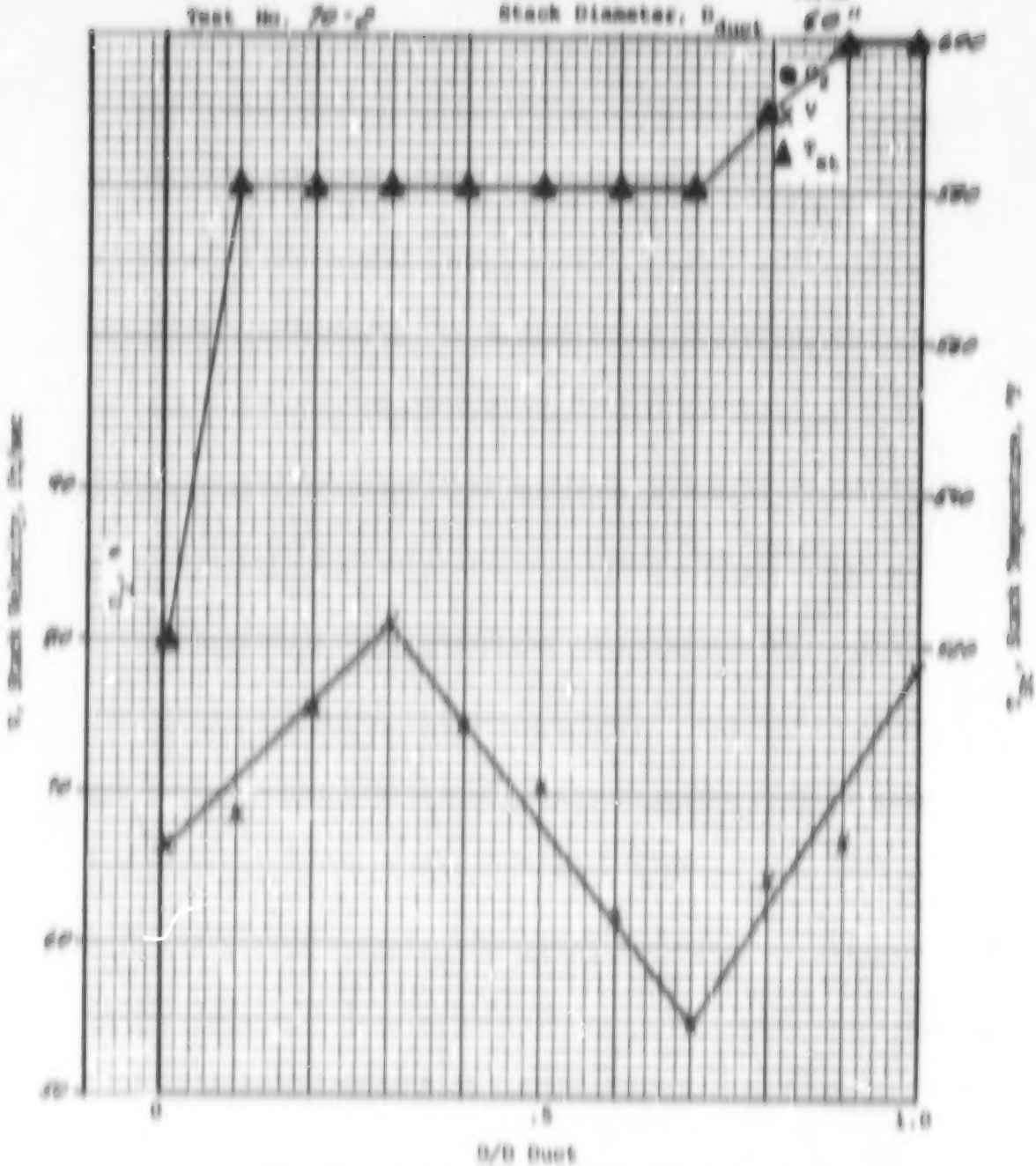
Test No.	10:10	10:17	10:18	10:19			
Test Type	low Air	Adjust Air	M Air	M Air			
Test Load (10^3 lb/hr)	70.0	69	69	70			
Excess O_2 (%)	6.8	6.9	6.8	9.8			
NO_x (ppm) #	934	998	920	998			
NO (ppm) #							
$(SO)_2$ dry (%)	13.9	10.6	9.0	8.2			
CO (ppm) #	188	171	256	314			
HC (ppm) #	20	40	54	64			
SO_x (ppm) #		580					
SO_2 (ppm) #		669					
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	144	142	140	142			
Final Stm Temp. (°F)	344	344	343	343			
Combus. Air Temp. (°F)	Amb.	Amb.	Amb	Amb.			
Stack Temp. (°F)	580	600	600	680			
Fuel Flow							
Fuel Temp. (°F)	100		102	104			
Fuel Pres. (psig)	94	95	90	80			
Furnace Pres. (in. H_2O)	.7	.8	.7	.5			
Register (% open)	60	60	60	60			

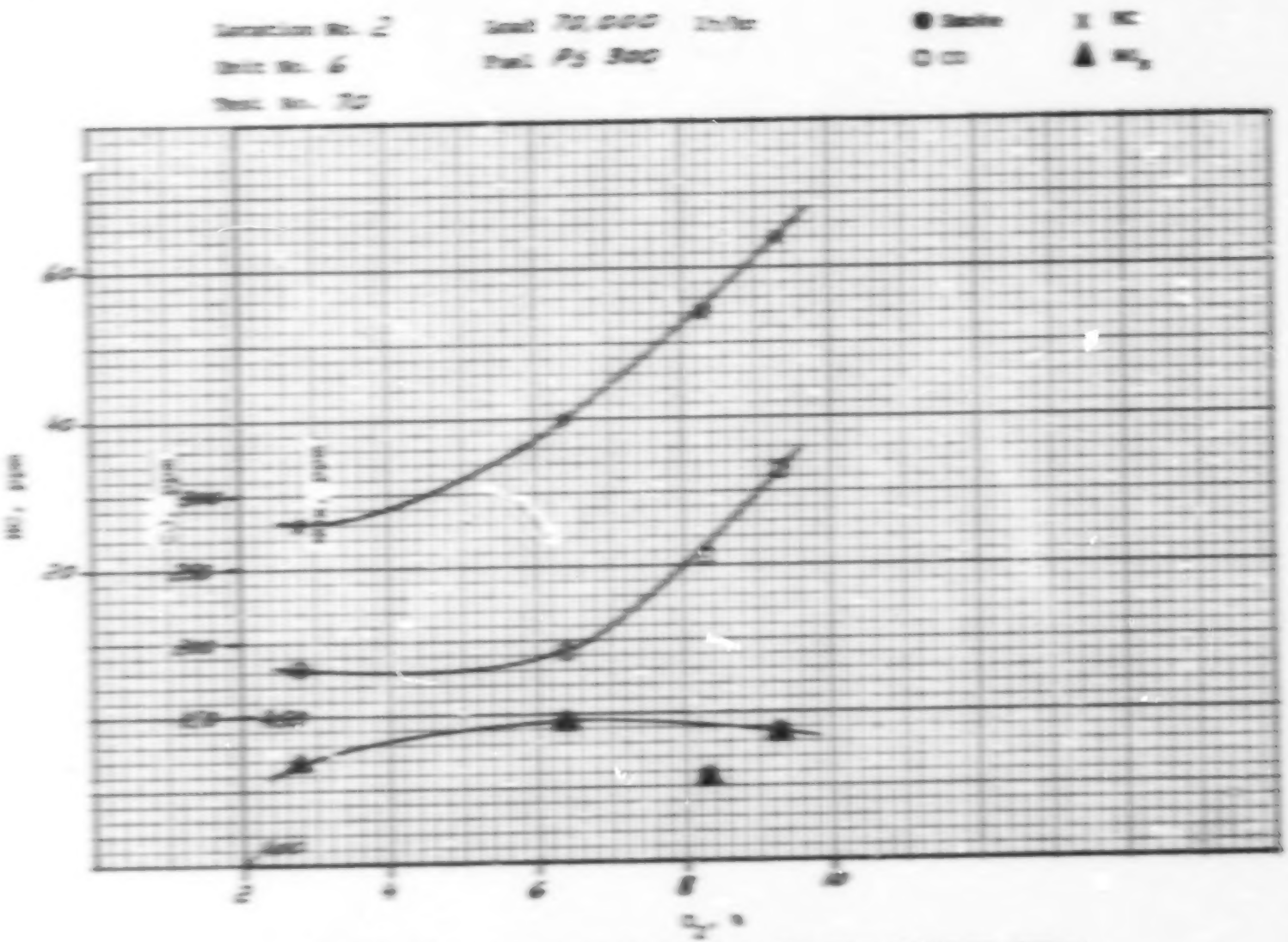
a @ 3% O_2 dry

STACK TRAVERSE DATA

Location No. [illegible]
Unit No. [illegible]
Test No. [illegible]

Fuel [illegible]
Load [illegible]
Stack Diameter, D_{duct} [illegible] in/ft [illegible]





Variation for Differential Boilers as a Function of Excess Oxygen

KVB, INC.

TO: Glenn Cato — Tech. Memo R-81

FROM: E. D. GUTH — December 17, 1973

SUBJECT: Fuel Oil Sulfur Analyses — Locations of Wells at Test Site

cc: Arlen Bell - R. Briones

The following samples were run to determine weight percent sulfur.

Sample No.	Date	S W %
Test 70-20	28 Nov. 73	1.10
Test 33-1	6 Dec. 73	.33
Test 59-1	10 Dec 73	.30

This is a preliminary report. An official Test Report will be sent to you as soon as the forms are available.

Eugene D. Guth

EDG:es

INDUSTRIAL BOILER DESIGN DATA

Location No. 1 Test No. 88, 91 Unit No. 2

Unit Description Cleaver Brooks Model CB 200-250

Installation Date	1968
Steam Output (10^3 lb/hr)	10.0
Design Pressure (psig)	150
Final Steam Temp (°F)	350
Furnace Type	Firetube
Furnace Dia. L-W-H (ft)	20 - 10
Furnace Area (ft^2)	80
Furnace Volume (ft^3)	38
Burner Description	1 steam driven Ring of air steam driven
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Nat Gas, #2 oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 270

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location _____

Unit _____

Fuel _____

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm) *							
NO (ppm) *							
O_2 dry (%)							
CO (ppm) *							
HC (ppm) *							
NO_x (ppm) *							
NO_2 (ppm) *							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow gal/hr							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

* @ 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location 3

Unit 2

Fuel #2 oil

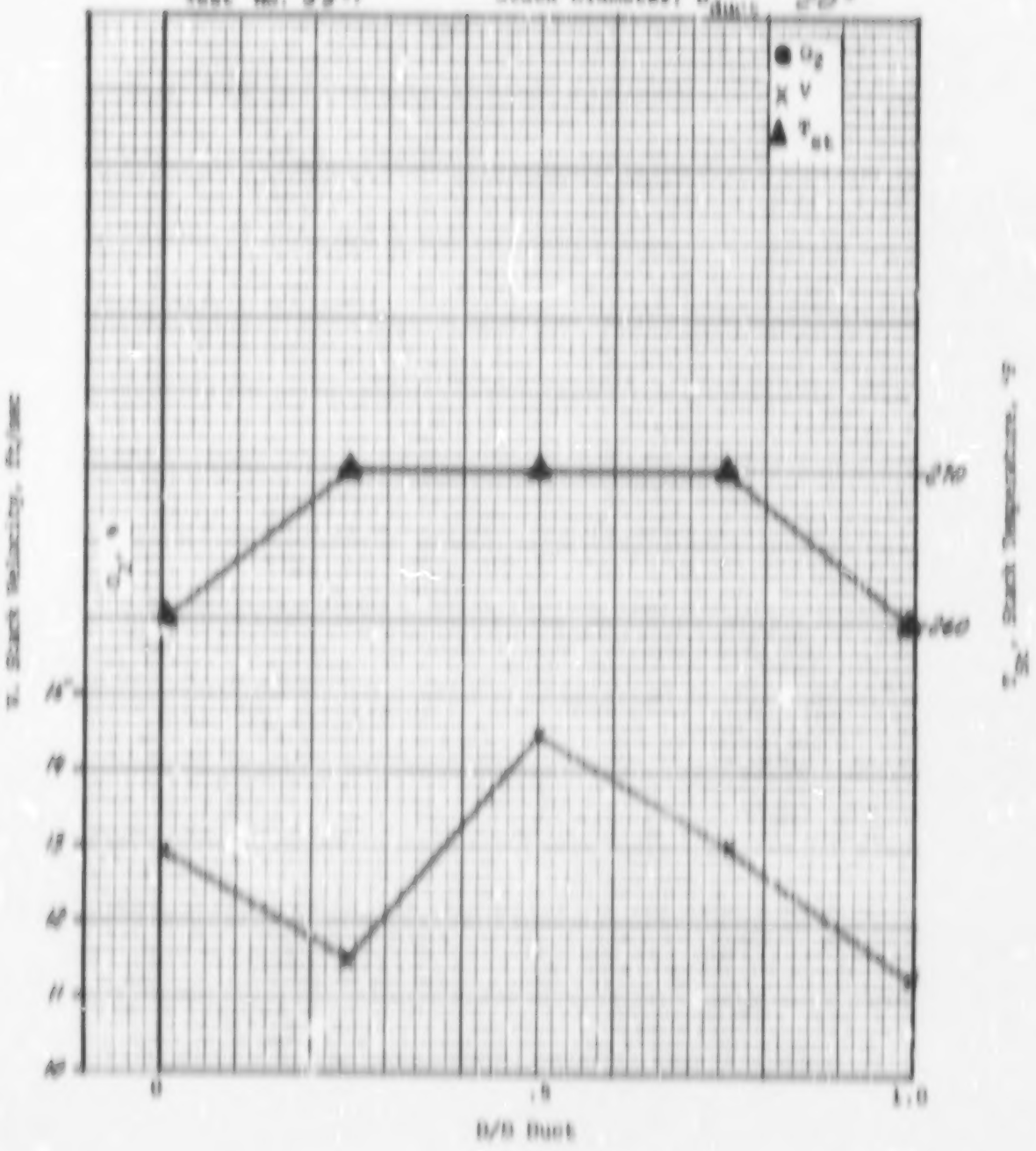
Test No.	33-8	33-9	33-10				
Test Type	Low Air	Low Air	Low Air				
Test Load (10^3 lb/hr)	5	5	5				
Excess O_2 (%)	4.0	3.9	3.6				
NO_x (ppm) *	150	157	153				
NO (ppm) *	139	140	137				
CO_2 dry (%)	11.3	12	12.3				
CO (ppm) *	0	0	0				
HC (ppm) *	32	28	30				
NO_x (ppm) *							
NO_2 (ppm) *							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			86				
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	20	20	20				
Final Stm Temp. (°F)	360	370	360				
Combus. Air Temp. (°F)	Amb	Amb	Amb				
Stack Temp. (°F)	300	304	300				
Fuel Flow	106	108	110				
Fuel Temp. (°F)	Amb	Amb	Amb				
Fuel Pres. (psig)	11.5	11.5	11.9				
Furnace Pres. (in. H_2O)							
Register (% open)							

* @ 3% O2 dry

STACK TRAVERSE DATA

Location No. 3
Unit No. 2
Test No. 82-1

Fuel #2 Oil
Load 500-650 lb/hr
Stack Diameter, D_{duct} 20'0"



KVB, INC.

TO: Glenn Cato

Tech. Memo R-83

FROM: E. D. GUTH

December 17, 1973

SUBJECT: Fuel Oil Sulfur Analyses

location 3
Unit 2
Test No. 83

CC: Arlen Bail - R. Brienza

The following samples were run to determine weight percent sulfur.

Sample No.	Date	S W B
Test 70-20	28 Nov. 73	1.10
Test 33-1	6 Dec. 73	.33
Test 59-1	10 Dec 73	.40

This is a preliminary report. An official Test Report will be sent to you as soon as the forms are available.

Eugene D. Guth

EDG:ss

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location S

Unit 2

Fuel Natural Gas

Test No.	41-1	41-2	41-3	41-4	41-5	41-6	41-7
Test Type	N. Load	N. Load	Variable Air	Variable Air	Low Load	Rated	Variable Air
Test Load (10^3 lb/hr)	10	9	7	5	3	7	5
Excess O_2 (%)	2.0	2.3	2.5	3.0	4.3	2.5	3.8
NO_x (ppm) #	91	89	92	100	114	90	80
NO (ppm) #	83	84	89	93	108	84	76
CO_2 dry (%)	7.0	7.7	7.4	7.0	5.8	7.4	6.0
CO (ppm) #	77	104	56	13	0	114	0
HC (ppm) #	297	340	329	286	163	307	256
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	81				78	82	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							20
Final Stm Temp. (°F)							760
Combus. Air Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	Amb
Stack Temp. (°F)	320	340	330	320		320	300
Fuel Flow ft^3/Hr	10	10.8	8.0	6.0	3.6	9.2	6.2
Fuel Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	Amb
Fuel Pres. (psig)							0.42
Furnace Pres. (in. H_2O)							
Register (% open)							

* @ 3% O2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location B

Unit 2

Fuel Natural Gas

Test No.	41-8	41-9	41-10				
Test Type	Excess Air	Excess Air	Excess Air				
Test Load (10^3 lb/hr)	5	5	5				
Excess O_2 (%)	0.7	0.8	3.6				
NO_x (ppm) *	52	72	66				
NO (ppm) *	49	69	63				
O_2 dry (%)	10.8	7.8	7.6				
CO (ppm) *	> 2000	0	0				
HC (ppm) *	582	247	196				
SO_x (ppm) *							
SO_2 (ppm) *							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			84				
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)		1200	1200				
Final Stm Temp. (°F)		950	948				
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.				
Stack Temp. (°F)	295	300	300				
Fuel Flow: ft^3/hr		13.2	12.0				
Fuel Temp. (°F)	Amb.	Amb.	Amb.				
Fuel Pres. (psig)		0.47	0.48				
Furnace Pres. (in. H_2O)							
Register (% open)							

* Dry O_2 basis

Location 3
Level 2
Test No. 41

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	85.0	15.0	1100
5	.0	0	.1	85.0	15.0	1100
10	.0	0	.1	85.0	15.0	1100
13	.0	0	.1	85.0	15.0	1100
14	0	.0	4.0	76.0	20.0	1120
15	0	.0	4.0	76.0	20.0	1120
24	0	.0	4.0	76.0	20.0	1120
25	.0	0	.1	85.0	15.0	1100
30	0	.0	4.0	76.0	20.0	1120
37	.0	0	.1	85.0	15.0	1100
38	.0	0	.1	85.0	15.0	1100
39	.0	.0	0.0	88.9	3.0	964
40	.0	0	5.0	95.0	0	900
41	.0	0	.1	85.0	15.0	1100
47	.0	0	5.0	95.0	0	900
48	.0	.0	0.0	88.9	3.0	964
49	.0	0	0.0	84.1	8.9	987
56	.0	0	.1	85.0	15.0	1100
60	.0	0	.1	85.0	15.0	1100
61	.0	0	.1	85.0	15.0	1100
69	.0	0	.1	85.0	15.0	1100
70	0.0	0	1.0	88.0	88.7	1040
71	0.0	0	1.0	88.0	88.7	1040
80	0	.0	4.0	76.0	20.0	1120

INDUSTRIAL BOILER DESIGN DATA

Location No. 4 Test No. 38, 39 Unit No. 4

Unit Description Cleaver Brooks Model CB 423 - 600

Installation Date	1980
Steam Output (10^3 lb/hr)	20
Design Pressure (psig)	200
Final Steam Temp (°F)	388°
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20-10
Furnace Area (ft^2)	100
Furnace Volume (ft^3)	47
Burner Description	1 Cleaver Brooks, Ring & Air atomizing Burn.
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Nat Gas & #2 oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	398°

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Natural Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	Normal	Base	Varying Air	Low Load	Varying Air	Low Air	Low Air
Test Load (10^3 lb/hr)	18.5	14.0	9.0	9.5	14.0	14.0	14.0
Excess O_2 (%)	6.9	6.8	6.8	11.8	7.2	6.0	9.8
NO_x (ppm) a	103	108	103	95	114	96	91
NO (ppm) a	91	94	88	86	101	89	81
$(O)_2$ dry (%)	7.7	7.6	7.8	4.8	7.3	8.1	8.9
CO (ppm) a							
HC (ppm) a	76	70	64	102	78	69	61
SO_x (ppm) a							
SO_2 (ppm) a							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		80					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	110	130	100	90	125	100	100
Final Stm Temp. (°F)	544	550	500	550	550	500	550
Combus. Air Temp. (°F)	Amb	Amb.	Amb	Amb	Amb	Amb	Amb
Stack Temp. (°F)	400						
Fuel Flow							
Fuel Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	Amb
Fuel Pres. (psig)	0.6	0.6	0.65	0.75	0.63	0.50	0.65
Furnace Pres. (in. H_2O)							
Register (% open)							

a [illegible]

BOILER EMISSION MEASUREMENTS
AND CONTROL SYSTEM DATA

Location [illegible]

Unit 4

Fuel Nat Gas

Test No.	38:8	38:9	38:10	38:11	38:12	38:13	
Test Type	Low Air	Ab/mi Air	Hi Air	Low Air	Low Air	Ab/mi Air	
Test Load (10^3 lb/hr)	10.0	9.0	9.0	9.0	9.0	10.0	
Excess O_2 (%)	.7	1.0	0.2	0.0	1.0	1.3	
NO_x (ppm) #	79	101	115	92	85	99	
NO (ppm) #	78	99	112	86	81	96	
$(O)_2$ dry (%)	10.9	1.9	2.0	9.1	10.7	1.9	
CO (ppm) #	400				500		
HC (ppm) #	59	138	100	78	54	81	
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MMBtu)						.0198	
Solid Part. (lb/MMBtu)						.0149	
Boiler Efficiency (%)						80	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	135	140	130	130	135	130	
Final Stm Temp. (°F)	500	500	500	500	500	500	
Combus. Air Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	
Stack Temp. (°F)						400	
Fuel Flow							
Fuel Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	
Fuel Pres. (psig)	0.05"	0.05"	0.05"	0.05"	0.05"	0.05"	
Furnace Pres. (in H_2O)							
Register (% open)							

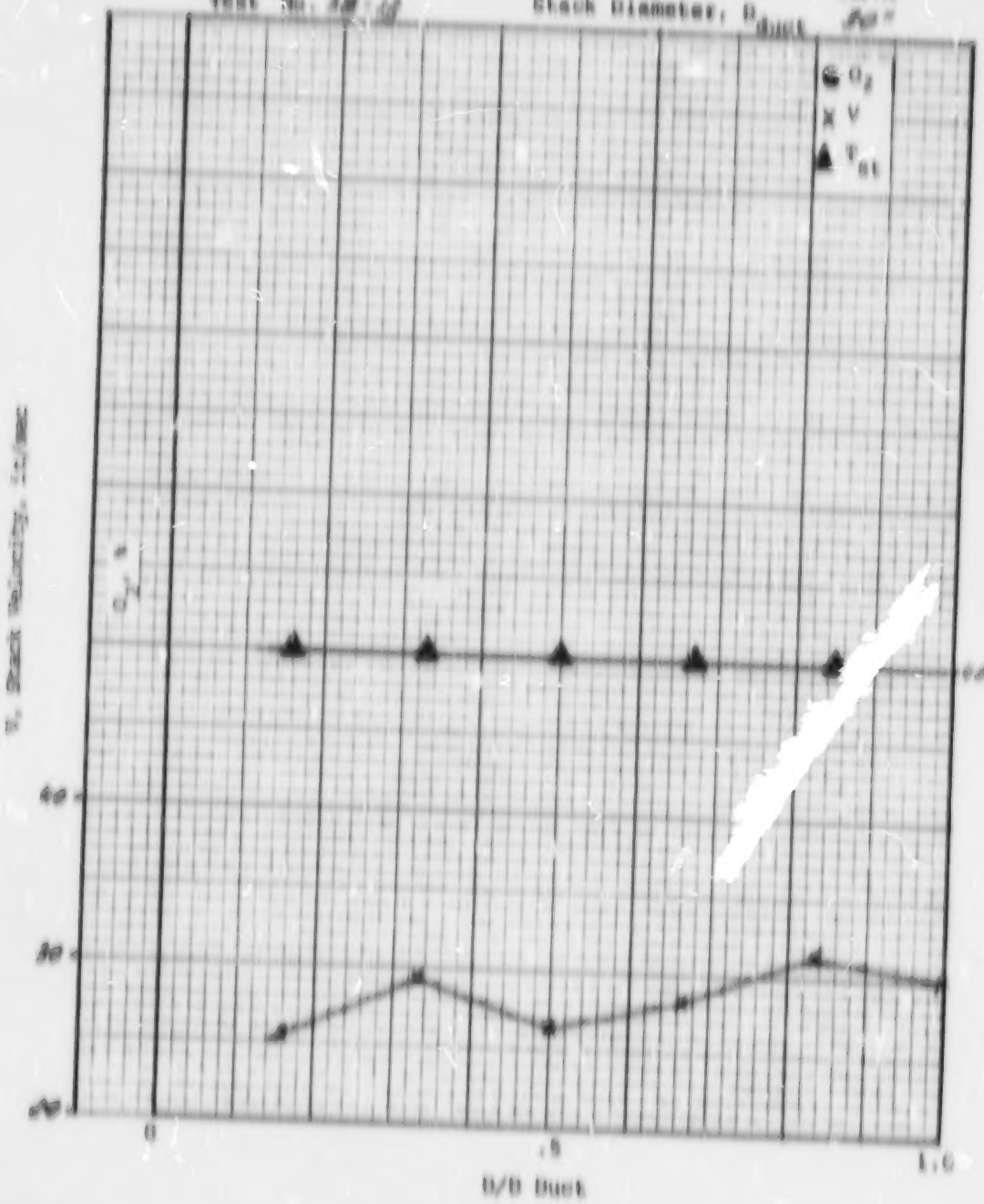
@ 3% O_2 dry

STACK TRAVERSE DATA

Location No. 9
Unit No. 6
Test No. [illegible]

Fuel [illegible]
Load [illegible]
Stack Diameter, D_{duct} [illegible]

lb/hr
[illegible]"



Document #
Appendix #
Test No. 30

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	95.0	13.1	1100
5	.0	0	.1	95.0	13.0	1100
12	.0	0	.1	95.0	13.0	1100
13	.0	0	.1	95.0	13.0	1100
14	0	.0	4.6	74.0	20.6	1109
15	0	.0	4.6	74.0	20.6	1109
24	0	.0	4.6	74.0	20.6	1109
25	.0	0	.1	95.0	12.0	1100
30	0	.0	4.6	71.0	20.6	1109
37	.0	0	.1	95.0	13.0	1100
38	.0	0	.1	95.0	13.0	1100
39	.6	.6	0.0	98.9	1.0	964
40	.6	0	1.9	95.6	0	966
41	.0	0	.1	95.0	13.0	1100
47	.0	0	1.9	95.6	0	966
48	.0	.6	0.0	98.9	1.0	964
49	.0	0	0.0	94.1	0.7	967
58	.0	0	.1	95.0	13.0	1100
60	.0	0	.1	95.0	13.0	1100
67	.0	0	.1	95.0	13.0	1100
69	.0	0	.1	95.0	13.0	1100
75	0.6	0	1.0	93.6	69.7	1040
77	3.0	0	1.0	27.0	69.7	1040
80	0	.0	4.6	74.0	20.6	1109

KVB, INC.

TO: Glenn Cato — Tech. Memo R-83

FROM: E. F. GUTH — December 17, 1973

SUBJECT: Fuel Oil Sulfur Analyses

cc: Arlen Bell - R. Briensa

The following samples were run to determine weight percent sulfur.

Sample No.	Date	S W S
Test 59-1	10 Dec 73	.30

This is a preliminary report. An official Test Report will be sent to you as soon as the forms are available.

Eugene F. Guth

EFG:ca

INDUSTRIAL BOILER DESIGN DATA

Location No: 9 Test No: 60 Unit No: 3

Unit Description Cleaver Brooks Model CB-4200-500

Installation Date	1970
Steam Output (10^3 lb/hr)	20
Design Pressure (psig)	150
Final Steam Temp (°F)	360
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20 - 10'
Furnace Area (ft^2)	100
Furnace Volume (ft^3)	67
Burner Description	1 Cleaver Brks. Ring of air shown. Gas
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Nat. Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 9
Unit 3
Fuel Nat. Gas

Test No.	80-1						
Test Type	Normal Air						
Test Load (10^3 lb/hr)	10						
Excess O_2 (%)	1.5						
NO_x (ppm) #	100						
NO (ppm) #	100						
O_2 dry (%)	10.6						
CO (ppm) #	<2000						
HC (ppm) #	31						
SO_x (ppm) #	———						
SO_2 (ppm) #	———						
Total Part. (lb/MBtu)	———						
Solid Part. (lb/MBtu)	———						
Boiler Efficiency (%)	———						
Smoke Spot No.	———						
Opacity (%)	———						
Final Stm Pres. (psig)	140						
Final Stm Temp. (°F)	360						
Combus. Air Temp. (°F)	Amb.						
Stack Temp. (°F)	———						
Fuel Flow	———						
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	0.44						
Furnace Pres. (in. H_2O)	———						
Register (% open)	———						

5) 1% O2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 4

Unit 4

Fuel #2 Oil

Test No.	54-1	54-2	54-3	54-4	54-5	54-6	54-7
Test Type	Base	Min Air	Low Air	Low Air	Optimum Air	Optimum Air	Optimum Air
Test Load (10^3 lb/hr)	9.3	9.3	9.3	9.3	10.3	10.0	9.3
Excess O_2 (%)	6.2	4.5	3.6	2.7	6.2	5.8	4.7
NO_x (ppm) #	190	193	160	145	189	194	190
NO (ppm) #	181	182	150	134	178	181	179
CO_2 dry (%)	11.0	10.2	10.4	13.2	10.4	10.2	11.4
CO (ppm) #							
HC (ppm) #	26	54	69	98	24	30	41
SO_x (ppm) #	173						
SO_2 (ppm) #	168						
Total Part. (lb/MBtu)	0.0281						
Solid Part. (lb/MBtu)	0.0145						
Boiler Efficiency (%)	85						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)	Amb	Amb	Amb	Amb	Amb	Amb	Amb
Stack Temp. (°F)	395						
Fuel Flow							
Fuel Temp. (°F)	70	70	70	70	70	70	70
Fuel Pres. (psig)	17	17.0	17.5	18	19	19	18.2
Furnace Pres. (in.H_2O)							
Register (% open)							

lb SO_2 dry

BOILER EMISSION REQUIREMENTS AND CONTROL, WORK DATA

Location 4

Unit 4

Fuel #2 Oil

Test No.	4-4-85						
Test Type	Wipe Air						
Test Load (10^3 lb/hr)	4.0						
Excess O_2 (%)	6.3						
NO_x (ppm) #	166						
NO (ppm) #	159						
CO_2 dry (%)	10.2						
CO (ppm) #	----						
HC (ppm) #	3.2						
SO_x (ppm) #	----						
SO_2 (ppm) #	----						
Total Part. (lb/MBtu)	----						
Solid Part. (lb/MBtu)	----						
Boiler Efficiency (%)	----						
Smoke Spot No.	----						
Opacity (%)	----						
Final Stm Press. (psig)	----						
Final Stm Temp. (°F)	----						
Combus. Air Temp. (°F)	Amb.						
Stack Temp. (°F)	----						
Fuel Flow	----						
Fuel Temp. (°F)	78						
Fuel Pres. (psig)	12.2						
Furnace Pres. (in. H_2O)	----						
Register (% open)	----						

@ 3% O_2 dry

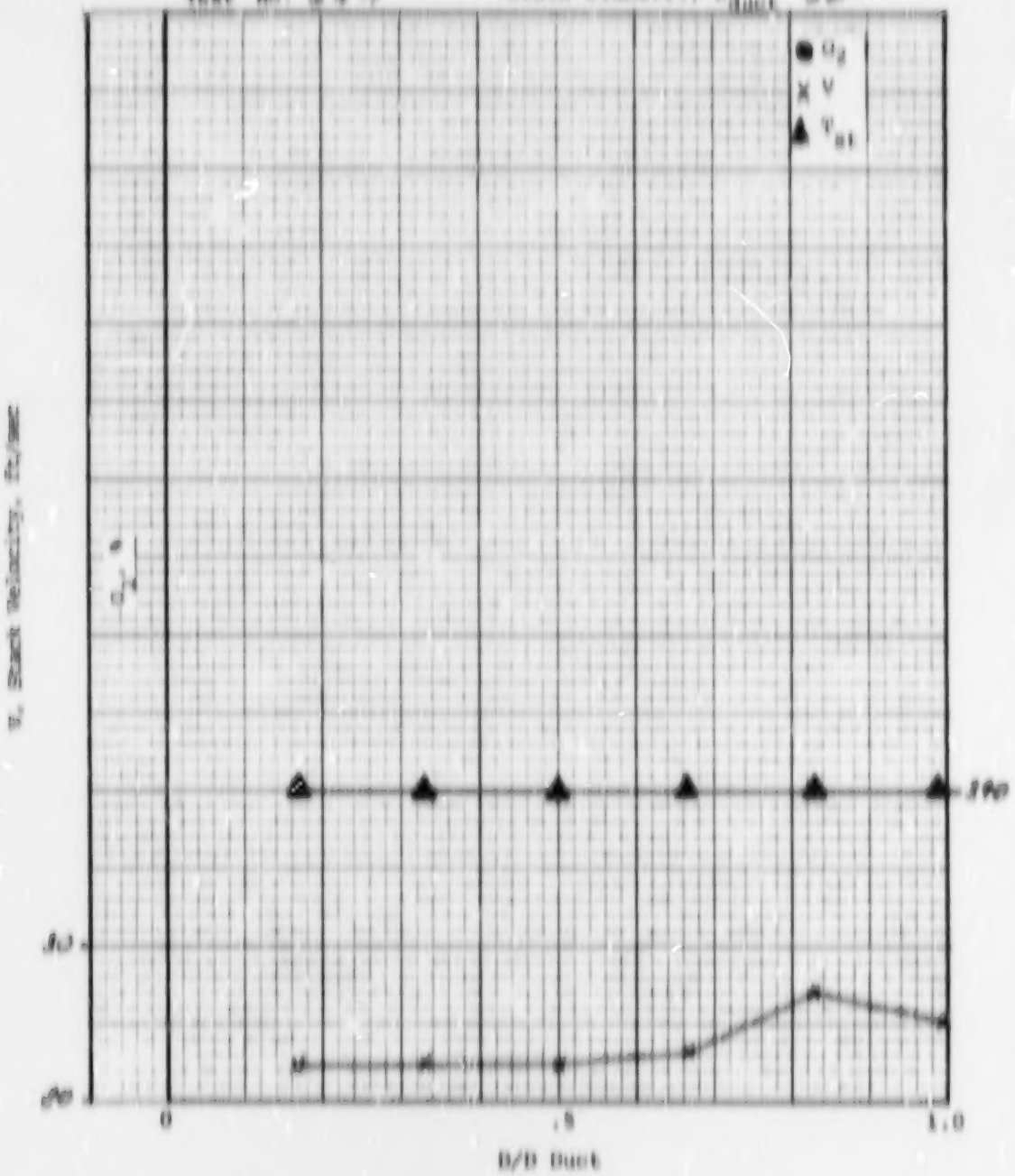
Baltimore Smoke No.
Reactions for Industrial Boilers as a Function of Excess Oxygen
O_2, %
NO, ppm
CO, ppm

STACK TRAVERSE DATA

Location No. 4
Unit No. 4
Test No. 6W-1

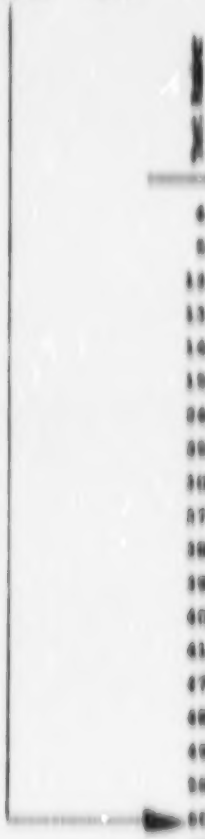
Fuel #6 Oil
Load 4 Gen.
Stack Diameter, D_{duct}

lb/hr
6W #



FUEL ANALYSIS SUMMARY

Gas Fuel



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.9	0	.1	85.0	13.0	1100
5	.9	0	.1	85.0	13.0	1100
12	.9	0	.1	85.0	13.0	1100
13	.9	0	.1	85.0	13.0	1100
14	0	.3	6.6	74.0	20.6	1120
15	0	.3	6.6	74.0	20.6	1120
24	0	.3	6.6	74.0	20.6	1120
25	.9	0	.1	85.0	13.0	1100
30	0	.3	6.6	74.0	20.6	1120
37	.9	0	.1	85.0	13.0	1100
38	.9	0	.1	85.0	13.0	1100
39	.0	.6	6.3	80.9	3.4	984
40	.0	0	3.9	96.6	0	986
41	.9	0	.1	85.0	13.0	1100
47	.0	0	3.9	96.6	0	986
48	.0	.6	6.3	80.9	3.4	984
49	.6	0	6.4	84.1	6.7	987
56	.9	0	.1	85.0	13.0	1100
60	.0	0	.1	85.0	13.0	1100
67	.9	0	.1	85.0	13.0	1100
68	.9	0	.1	85.0	13.0	1100
76	2.5	0	1.3	28.6	69.7	1340
77	2.5	0	1.3	28.6	69.7	1340
80	0	.3	6.6	74.0	20.6	1120

INDUSTRIAL BOILER DESIGN DATA

Location No. 6 Test No. 4 Unit No. FB-9

Unit Description Vicker Steam Generator

Installation Date	1954
Steam Output (10^3 lb/hr)	25 #
Design Pressure (psig)	100
Final Steam Temp (°F)	370
Furnace Type	Watertube
Furnace Size L-W-H (ft)	
Furnace Area (ft^2)	
Furnace Volume (ft^3)	
Burner Description	1 Ringburner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Nat. Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 490

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location S

Unit 7/8 - 8

Fuel Nat Gas

Test No.	8-1	8-2	8-3	8-4	8-5	8-6	8-7
Test Type	As found	As found	Normal Air	Normal Air	As found	Normal Air	Normal Air
Test Load (10^3 lb/hr)	520	520	518	520	520	520	518
Excess O_2 (%)	2.4	2.0	3.8	3.8	1.6*	2.4	3.8*
NO_x (ppm) #	76	60	77	77	76	56	77
NO (ppm) #	71	58	76	75	74	54	72
$(O)_2$ dry (%)	3.0	10.1	3.0	3.8	3.0	3.4	3.6
CO (ppm) #	180	1008	0	0	0	375	0
HC (ppm) #	30	47	50	48	66	41	74
$(O)_x$ (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)	0.0050						
Solid Part. (lb/MBtu)	0.0018						
Boiler Efficiency (%)	78	78			79		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	120	116	118	116	110	114	112
Final Stm Temp. (°F)	350	348	350	348	344	350	345
Combus. Air Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.
Stack Temp. (°F)	440	500	444	430	378	440	440
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.	Amb.
Fuel Pres. (psig)	5.8	5.5	5	5.8	5.5*	5.7	5.8
Furnace Pres. (in. H_2O)							
Register (% open)							

@ 3% O2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 6"

Unit F/G - 8

Fuel Mist Gas

Test No.	8-6	8-7	8-10	8-11	8-12	8-13	8-14
Test Type	Low Air	Mod Air	Mod Air	Mod Air	Mod Air	Hi Air	Mod Air
Test Load (10^3 lb/hr)	13.5	15.5	16.0	16.0	16.0	16.0	14.0
Excess O_2 (%)	6.7	5.1	4.2	4.4	4.1	5.8	4.9
NO_x (ppm) #	60	70	64	67	65	80	62
HC (ppm) #	70	67	67	64	66	77	79
SO_2 Dry (%)	7.0	0.1	0.6	0.0	0.0	7.0	6.9
CO (ppm) #	0	0	0	0	0	0	0
HC (ppm) #		49	37	46	30	40	40
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	100	120	120	117	117	117	114
Final Stm Temp. (°F)	500	500	500	500	500	500	500
Combus. Air Temp. (°F)	Amb.						"
Stack Temp. (°F)	400	400	405	405	405	400	400
Fuel Flow (#/hr)							7800
Fuel Temp. (°F)	Amb.						"
Fuel Pres. (psig)	4.7	4.8	4.8	4.8	4.8	4.8	5.2
Furnace Pres. (in. H_2O)							
Register (% open)							

By Wt Dry

BOILER EMISSION MEASUREMENTS
AND CONTROL WORK DATA

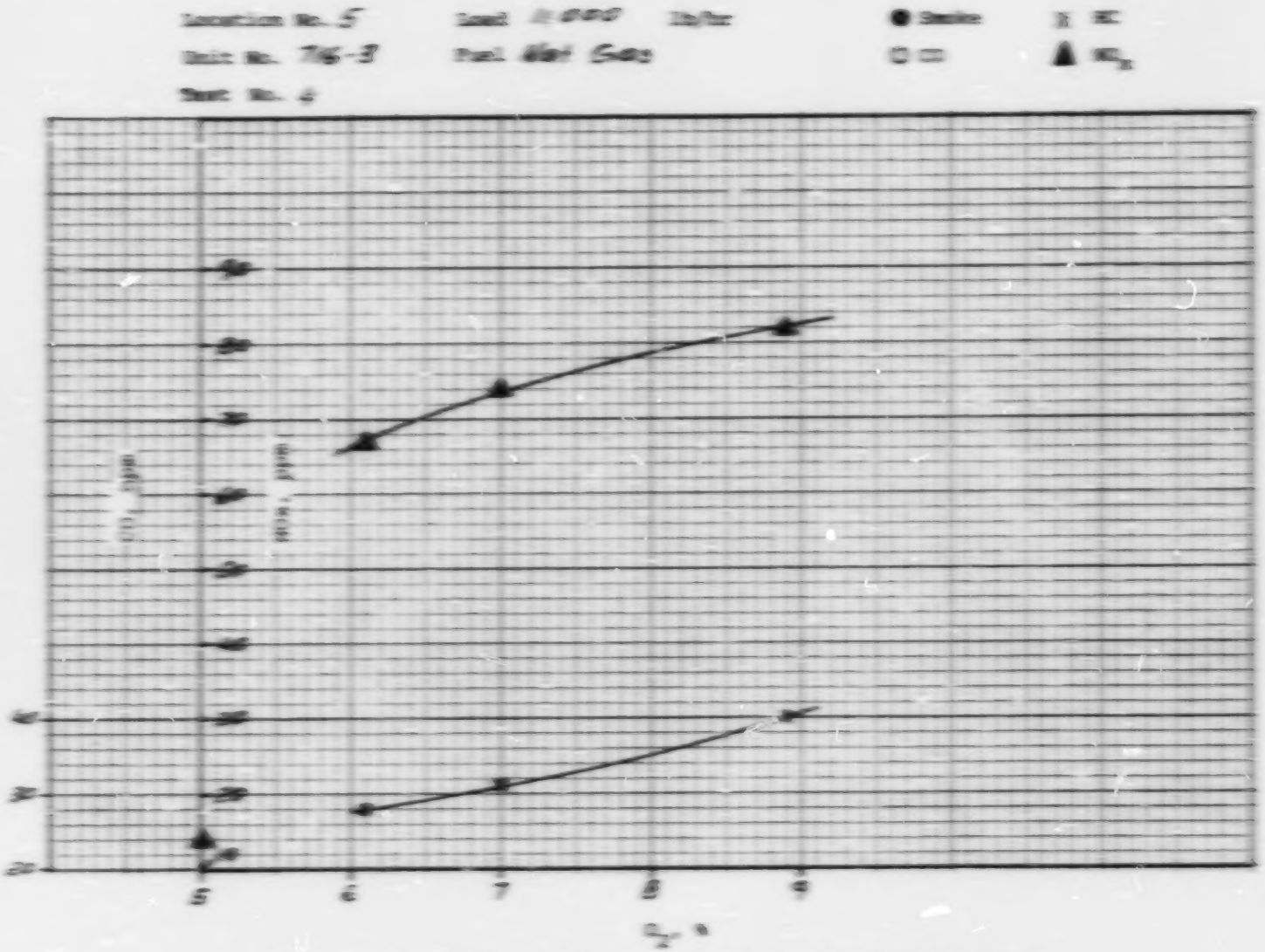
Location 5"

Unit #6 - 5

Fuel Nat. Gas

Test No.	4-10	4-11	4-12				
Test Type	Opt. Air	Opt. Air	Opt. Air				
Test Load (10^3 lb/hr)	110	110	110				
Excess O_2 (%)	1.0	0.2	0.0				
NO_x (ppm) #	74	61	14				
NO (ppm) #	72	65	12				
$(N)_2$ dry (%)	82	78	82				
CO (ppm) #	0	0	381				
HC (ppm) #	31	28	30				
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	110	110	110				
Final Stm Temp. (°F)	540	540	540				
Combus. Air Temp. (°F)	Amb.		"				
Stack Temp. (°F)	400	411	395				
Fuel Flow ft³/hr	9300	9300	9300				
Fuel Temp. (°F)	Amb.		"				
Fuel Pres. (psig)	5.2	5.2	5.2				
Furnace Pres. (in. H_2O)							
Register (% open)							

@ 3% O2 dry

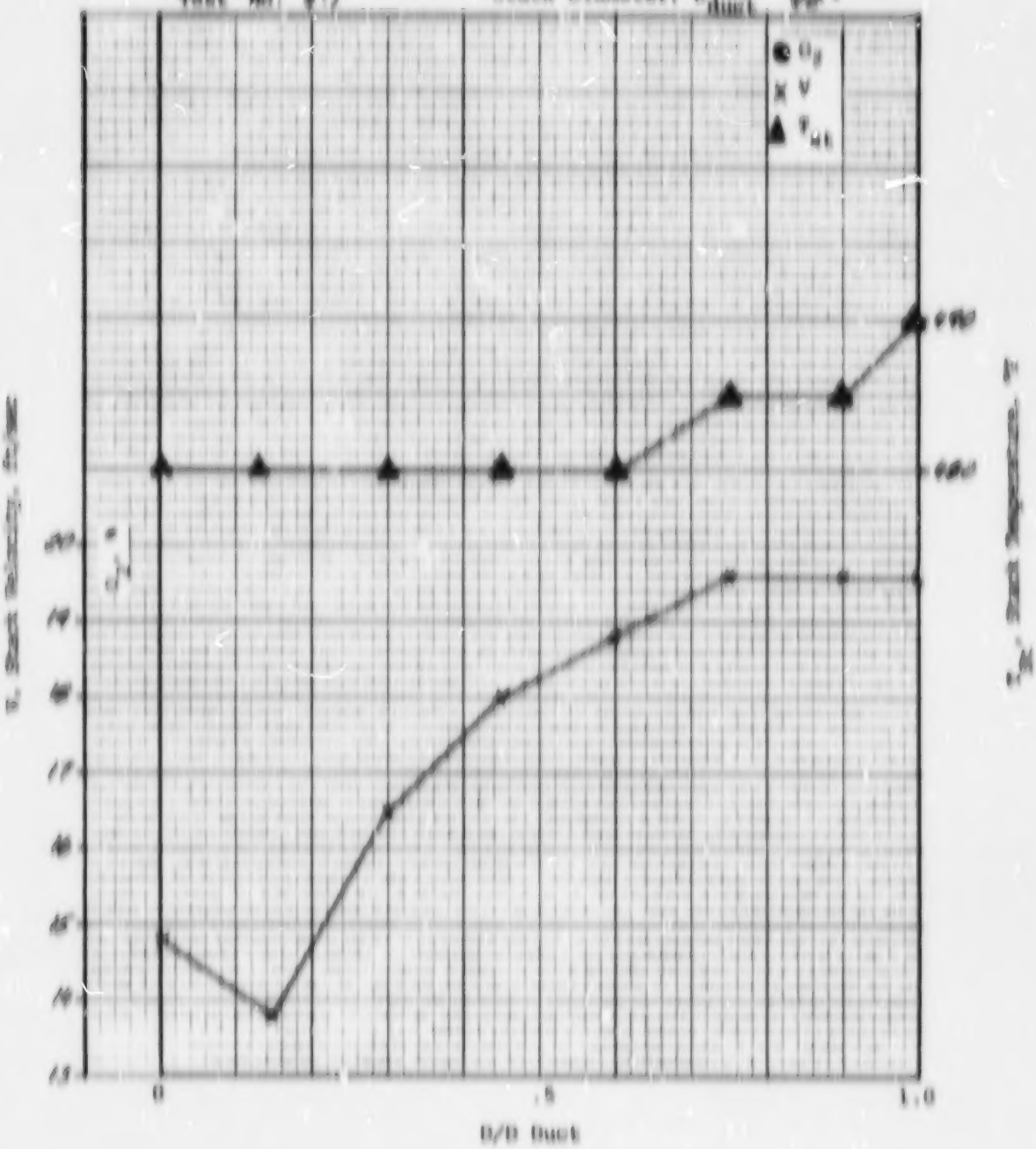


Emissions for Industrial Boilers as a Function of Excess Oxygen

STACK TRAVERSE DATA

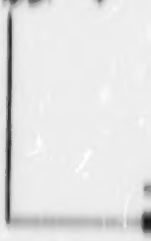
Location No. [illegible]
Unit No. [illegible]
Test No. [illegible]

Fuel [illegible]
Load [illegible] lb/hr
Stack Diameter, D_{duct} [illegible] ft



FUEL ANALYSIS SUMMARY

Gas Fuel



4	.0	0	.1	00.0	10.0	1100
0	.0	0	.1	00.0	10.0	1100
10	.0	0	.1	00.0	10.0	1100
13	.0	0	.1	00.0	10.0	1100
14	0	.0	0.0	74.0	00.0	1100
15	0	.0	0.0	74.0	00.0	1100
04	0	.0	0.0	74.0	00.0	1100
05	.0	0	.1	00.0	10.0	1100
00	0	.0	0.0	74.0	00.0	1100
07	.0	0	.1	00.0	10.0	1100
08	.0	0	.1	00.0	10.0	1100
09	.0	.0	0.0	00.0	0.0	000
40	.0	0	0.0	00.0	0	000
41	.0	0	.1	00.0	10.0	1100
47	.0	0	0.0	00.0	0	000
48	.0	.0	0.0	00.0	0.0	000
49	.0	0	0.0	00.1	0.7	207
50	.0	0	.1	00.0	10.0	1100
00	.0	0	.1	00.0	10.0	1100
07	.0	0	.1	00.0	10.0	1100
00	.0	0	.1	00.0	10.0	1100
75	0.0	0	1.0	00.0	00.7	1040
77	0.0	0	1.0	00.0	00.7	1040
00	0	.0	0.0	74.1	00.0	1100

INDUSTRIAL BOILER DESIGN DATA

Location No: 6 Test No: 3P Unit No. 268-3

Unit Description American Standard, Williamsburg

Installation Date	1968
Steam Output (10^3 lb/hr)	40.0
Design Pressure (psig)	50
Final Steam Temp (°F)	270
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20-9
Furnace Area (ft^2)	68
Furnace Volume (ft^3)	85
Burner Description	1 Ringburner & Oilgun
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Nat. Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~275

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL BOOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm) *							
NO (ppm) *							
O_2 dry (%)							
CO (ppm) *							
HC (ppm) *							
SO_x (ppm) *							
SO_2 (ppm) *							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

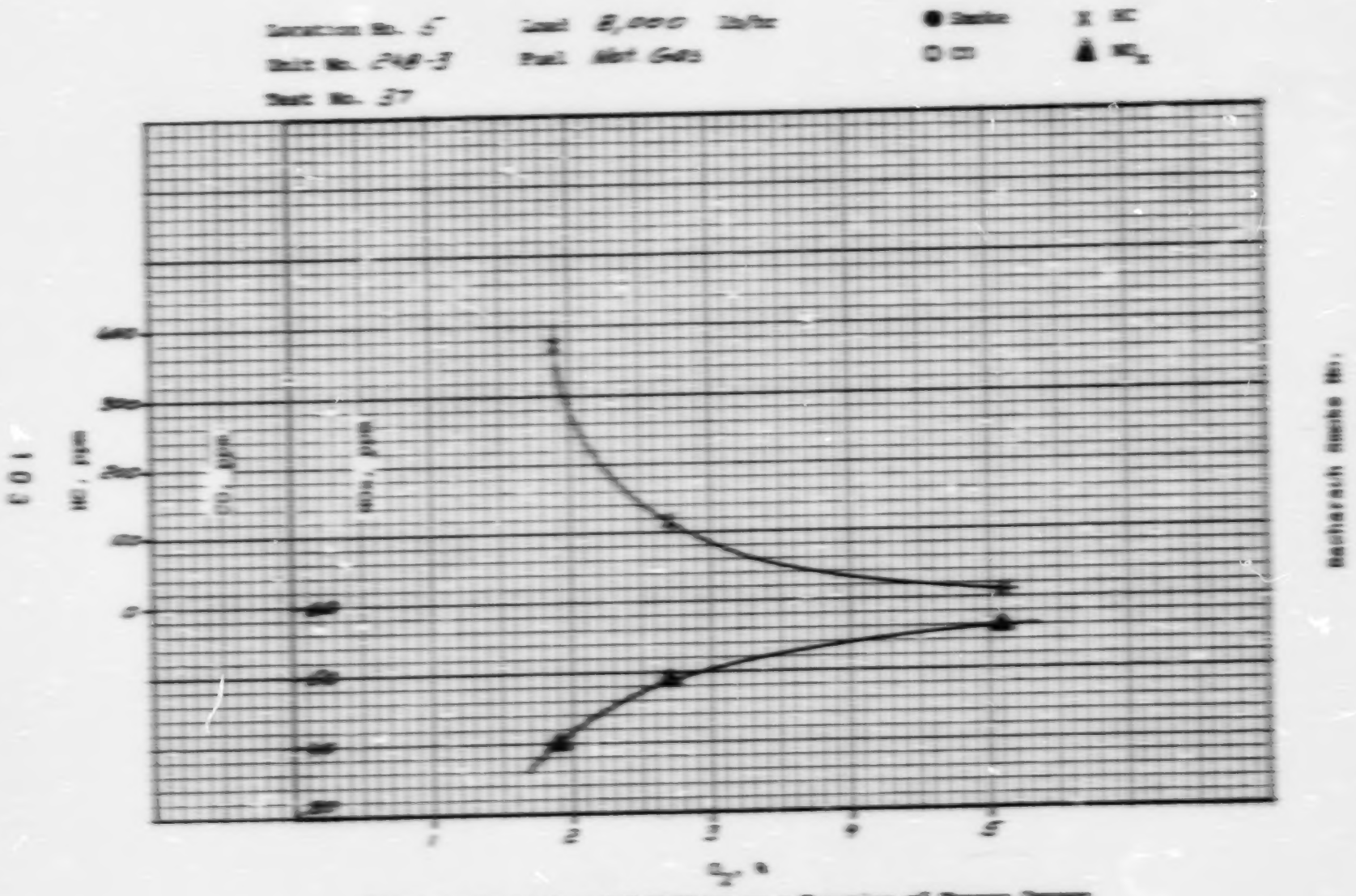
* @ 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location S
Unit #4 & 5
Fuel Ref. Coal

Test No.	37-6	37-7					
Test Type	Avg	Avg/wt Ave					
Test Load (10^3 lb/hr)	6	7					
Excess O_2 (%)	5.1	6.1					
NO_x (ppm) *	56	60					
NO (ppm) *	53	57					
$(S)_2$ dry (%)	0.4	0.0					
CO (ppm) *	0	0					
HC (ppm) *	16	12					
SO_4 (ppm) *							
SO_2 (ppm) *							
Total Part. (lb/MBtu)	0.0043						
Solid Part. (lb/MBtu)	0.0029						
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1515						
Final Stm Temp. (°F)	1150	1050					
Combus. Air Temp. (°F)	Amb.	Amb.					
Stack Temp. (°F)	270						
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.					
Fuel Pres. (psig)	0.00	0.04					
Furnace Pres. (in. H_2O)							
Register (% open)							

* @ 3% O_2 dry

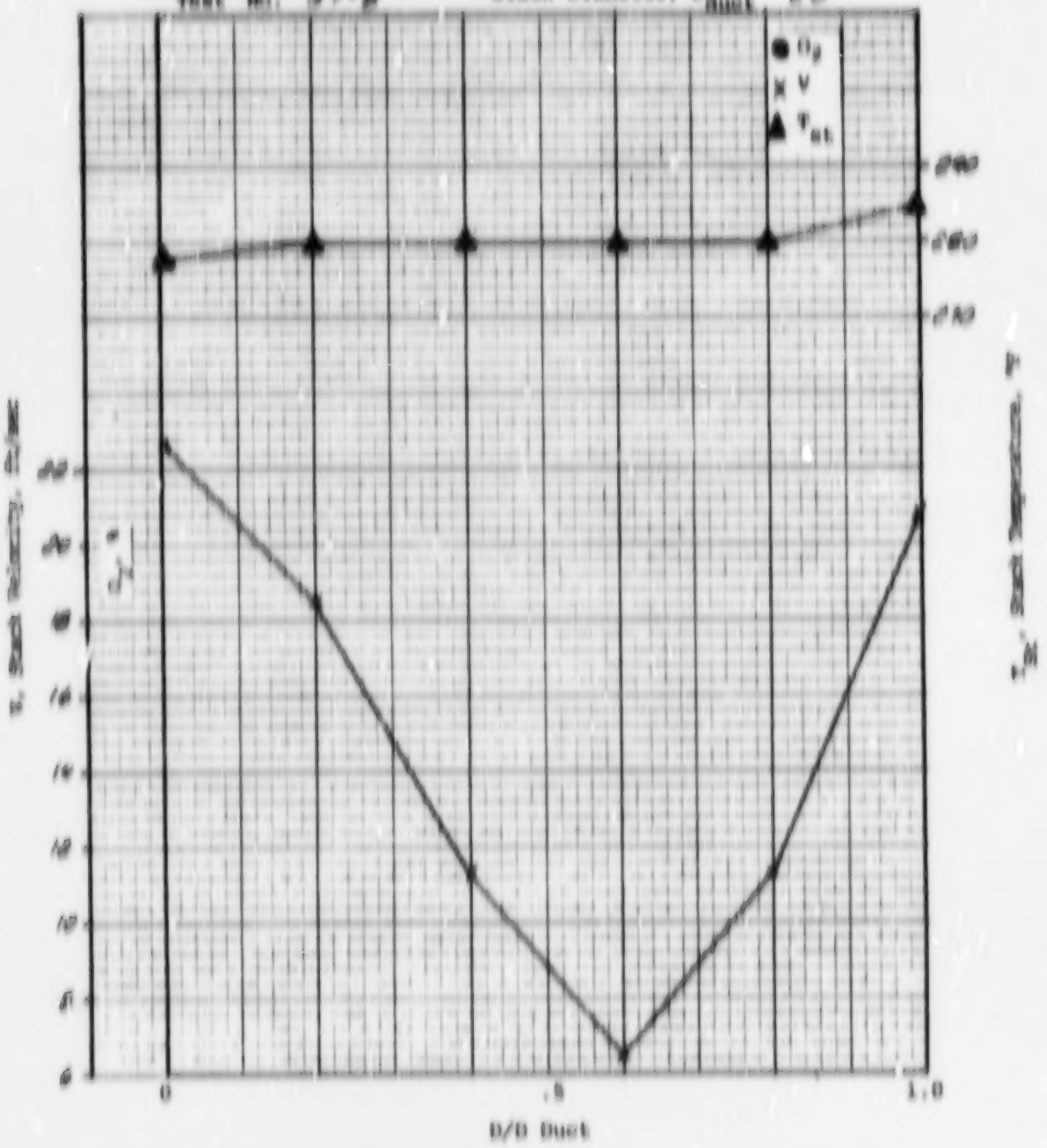


Emissions for Industrial Boilers as a Function of Excess Oxygen

STACK TRAVERSE DATA

Location No. 5"
Unit No. 2 4 [illegible] - 3
Test No. 3 7 - [illegible]

Fuel 4/6 of. Grade
Load [illegible], [illegible] [illegible] lb/hr
Stack Diameter, D_{Duct} [illegible]"



Location 5
Unit 2&3
Test No. 37

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	85.0	13.0	1100
5	.0	0	.1	85.0	13.0	1100
12	.0	0	.1	85.0	13.0	1100
13	.0	0	.1	85.0	13.0	1100
14	0	.0	0.0	74.0	26.0	1139
15	0	.0	0.0	74.0	26.0	1139
26	0	.0	0.0	74.0	26.0	1139
25	.0	0	.1	85.0	13.0	1100
30	0	.0	0.0	74.0	26.0	1139
37	.0	0	.1	85.0	13.0	1100
38	.0	0	.1	85.0	13.0	1100
39	.0	.0	0.3	96.9	3.0	954
40	.0	0	3.0	99.0	0	905
41	.0	0	.1	85.0	13.0	1100
47	.0	0	3.0	99.0	0	906
48	.0	.0	0.3	96.9	3.0	954
49	.0	0	0.0	94.1	5.7	987
58	.0	0	.1	85.0	13.0	1100
60	.0	0	.1	85.0	13.0	1100
61	.0	0	.1	85.0	13.0	1100
69	.0	0	.1	85.0	13.0	1100
76	0.0	0	1.3	33.0	69.7	1060
77	0.0	0	1.3	31.0	69.7	1060
80	0	.0	0.0	74.0	26.0	1139

INDUSTRIAL BOILER DESIGN DATA

Location No. [illegible] Test No. [illegible] Unit No. [illegible]

Unit Description [illegible]

Installation Date	
Steam Output (10^3 lb/hr)	8.0
Design Pressure (psig)	50
Final Steam Temp (°F)	270
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20 - 4
Furnace Area (ft^2)	80
Furnace Volume (ft^3)	91
Burner Description	1 Ringburner & Oilgun
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Nat. Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 320

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL RACK DATA

Location S"

Unit #4B-1

Fuel Natural Gas

Test No.	4B-1	4B-2	4B-3	4B-4	4B-5	4B-6	4B-7
Test Type	Normal	Boiler	Optimum	Optimum	Optimum	Optimum	Optimum
Test Load (10^3 lb/hr)	80	60	70	30	10	60	60
Excess O_2 (%)	10.2	11.0	11.9	12.0	15.0	6.2	5.8
NO_x (ppm) #	77	62	63	58	52	78	87
NO (ppm) #	75	60	61	58	50	76	86
$(O)_2$ dry (%)	6.4	4.8	4.9	3.7	2.8	4.9	4.2
CO (ppm) #	0	0	0	0	0	0	145
HC (ppm) #	27	33	41	73	4500	24	824
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	12.0	12.0	12.0	11.0	9.0	11.0	12.0
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)	Amb.						"
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)	Amb.						"
Fuel Pres. (psig)	0.09	0.08	0.08			0.09	0.09
Furnace Pres. (in.H_2O)							
Register (% open)							

@ 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location S

Unit 248 -1

Fuel Nat. Gas

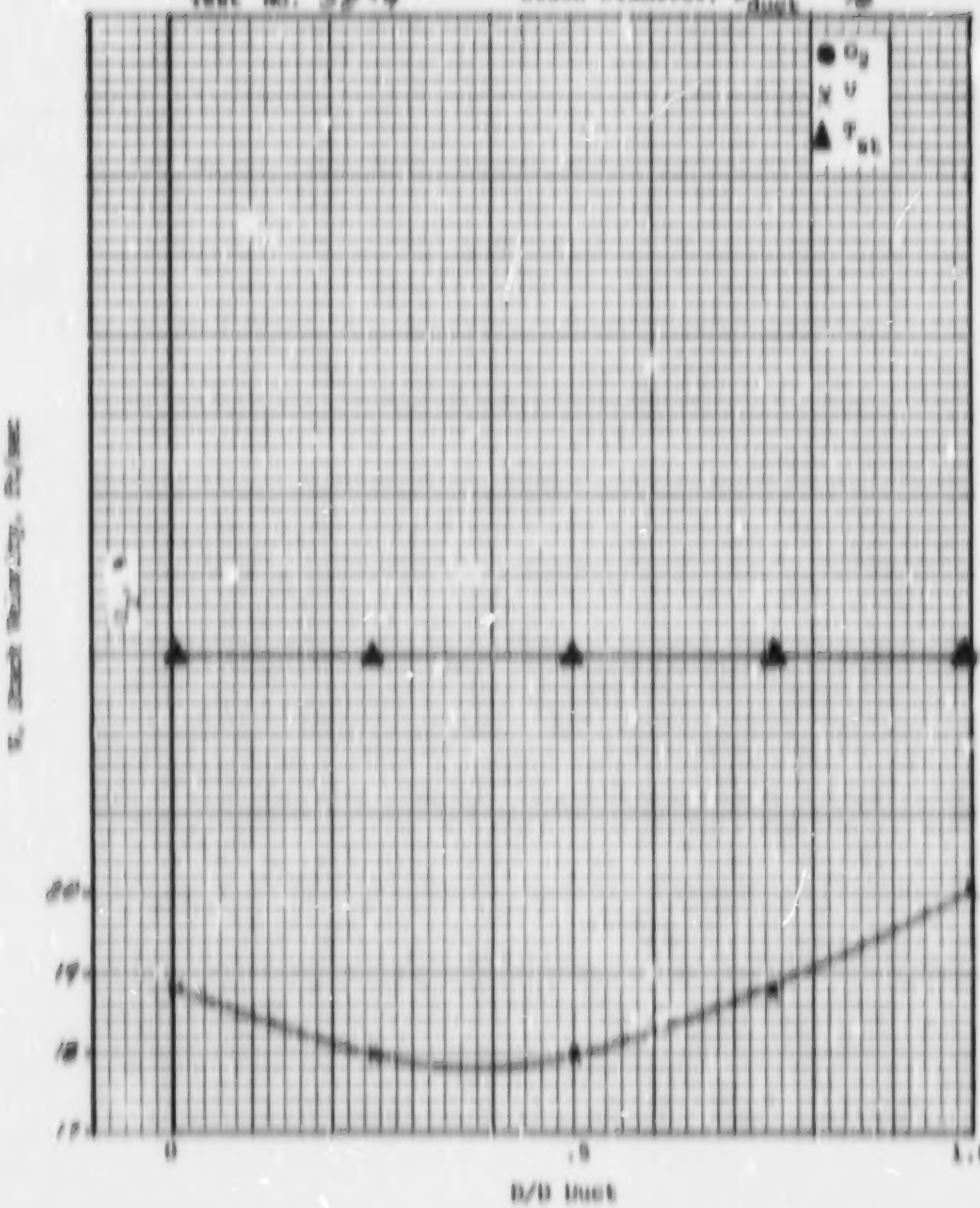
Test No.	5B:0	5B:9					
Test Type	Full Air	Full Sweet					
Test Load (10^3 lb/hr)	0.9	2.8					
Excess O_2 (%)	3.2	14.8					
NO_x (ppm) #	92	16					
CO (ppm) #	39	4					
$(O)_2$ dry (%)	9.4	2.5					
(O) (ppm) #	20000	3200					
TC (ppm) #	289	399					
SO_x (ppm) #	------	------					
SO_2 (ppm) #	------	------					
Total Part. (lb/MBtu)	------	0.0159					
Solid Part. (lb/MBtu)	------	0.0029					
Boiler Efficiency (%)	------	------					
Smoke Spot No.	------	------					
Opacity (%)	------	------					
Final Stm Pres. (psig)	12.0	12.0					
Final Stm Temp. (°F)	------	------					
Combus. Air Temp. (°F)	Amb.	Amb.					
Stack Temp. (°F)	------	219					
Fuel Flow	------	------					
Fuel Temp. (°F)	Amb.	Amb.					
Fuel Pres. (psig)	0.01	------					
Furnace Pres. (in. H_2O)	------	------					
Register (% open)	------	------					

@ 3% O_2 dry

STACK TRAVERSE DATA

Location No. 5
Unit No. 3486-1
Test No. 5B-9

Fuel Nat. Gas
Load 2,800 lb/hr
Stack Diameter, D_{duct} 48"



Location 5"
Unit 1 & 2 1
Test No. 58

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.9	0	.1	85.0	13.9	1100
9	.9	0	.1	85.0	13.9	1100
12	.9	0	.1	85.0	13.9	1100
13	.9	0	.1	85.0	13.9	1100
14	0	.9	4.6	74.0	20.6	1139
15	0	.9	4.6	74.0	20.6	1139
16	0	.9	4.6	74.0	20.6	1139
35	.9	0	.1	85.0	13.9	1100
36	0	.9	4.6	74.0	20.6	1139
37	.9	0	.1	85.0	13.9	1100
38	.9	0	.1	85.0	13.9	1100
39	.6	.4	0.9	88.9	3.4	984
40	.9	0	3.0	95.6	0	966
43	.9	0	.1	85.0	13.9	1100
47	.9	0	3.0	95.6	0	966
48	.6	.4	0.9	88.9	3.4	984
49	.9	0	0.4	94.1	0.7	987
53	.9	0	.1	85.0	13.9	1100
56	.9	0	.1	85.0	13.9	1100
57	.9	0	.1	85.0	13.9	1100
58	.9	0	.1	85.0	13.9	1100
76	0.6	0	1.5	33.6	64.7	1548
77	3.9	0	1.5	33.6	60.7	1548
80	0	.9	4.6	74.0	20.6	1139

INDUSTRIAL BOILER DESIGN DATA

Location No. 6 Test No. 65, 66 Unit No. 3

Unit Description CE, Walsh & Weidner Boiler, Serial No. 10687

Installation Date	1929 / 1971
Steam Output (10^3 lb/hr)	150
Design Pressure (psig)	710
Final Steam Temp (°F)	680
Furnace Type	Waterwall
Furnace Size L-W-H (Ft)	26-21-35
Furnace Area (Ft^2)	2681
Furnace Volume (Ft^3)	9100
Burner Description	4 Steam Ring & Steam atom Oil Guns
Horiz. Burner Spacing (Ft)	4
Vert. Burner Spacing (Ft)	0
Test Fuel	Nat Gas & #2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	~ 210
Stack Temp (°F)	~ 275 on Nat Gas ; ~ 285 on #2 Oil

Comments: Furnace and Backpass were changed in 1971

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 6

Unit 8

Fuel Nat. Gas

Test No.	85-1	85-2	85-3	85-4	85-5	85-6	85-7
Test Type	Without Air	Without Air	Base	Hi Excess	Without Air	Low Excess	Without Air
Test Load (10^3 lb/hr)	85	100	125	150	150	60	110
Excess O_2 (%)	10.6	13.0	11.8	11.5	11.0	18.5	14.0
NO_x (ppm) #	184	286	277	350	300	104	309
NO (ppm) #	193	246	277	340	298	104	215
CO_2 dry (%)	8.0	8.8	9.6	9.8	9.6	5.8	9.6
CO (ppm) #	0	0	0	0	0	98	40
HC (ppm) #	54	44	37	40	60	47	20
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)					0.0013		
Solid Part. (lb/MBtu)					0.0008		
Boiler Efficiency (%)			79	80		81	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	820	810	800	810	820	775	830
Final Stm Temp. (°F)	970	960	955	970	971	880	975
Combus. Air Temp. (°F)					332		310
Stack Temp. (°F)	540	560	575	590	590	530	580
Fuel Flow $ft^3/hr \times 10^3$	80	98	130	167	145	60	110
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	9.8	9.7	9.8	9.8	9.8		9.8
Furnace Pres. (in H_2O)	-0.02	-0.18	-0.1	-0.45	-0.13	-0.1	-0.15
Registers (% open)	100	100	100	100	100	100	100

8 346 85 wpy

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 6

Unit 3

Fuel Natural Gas

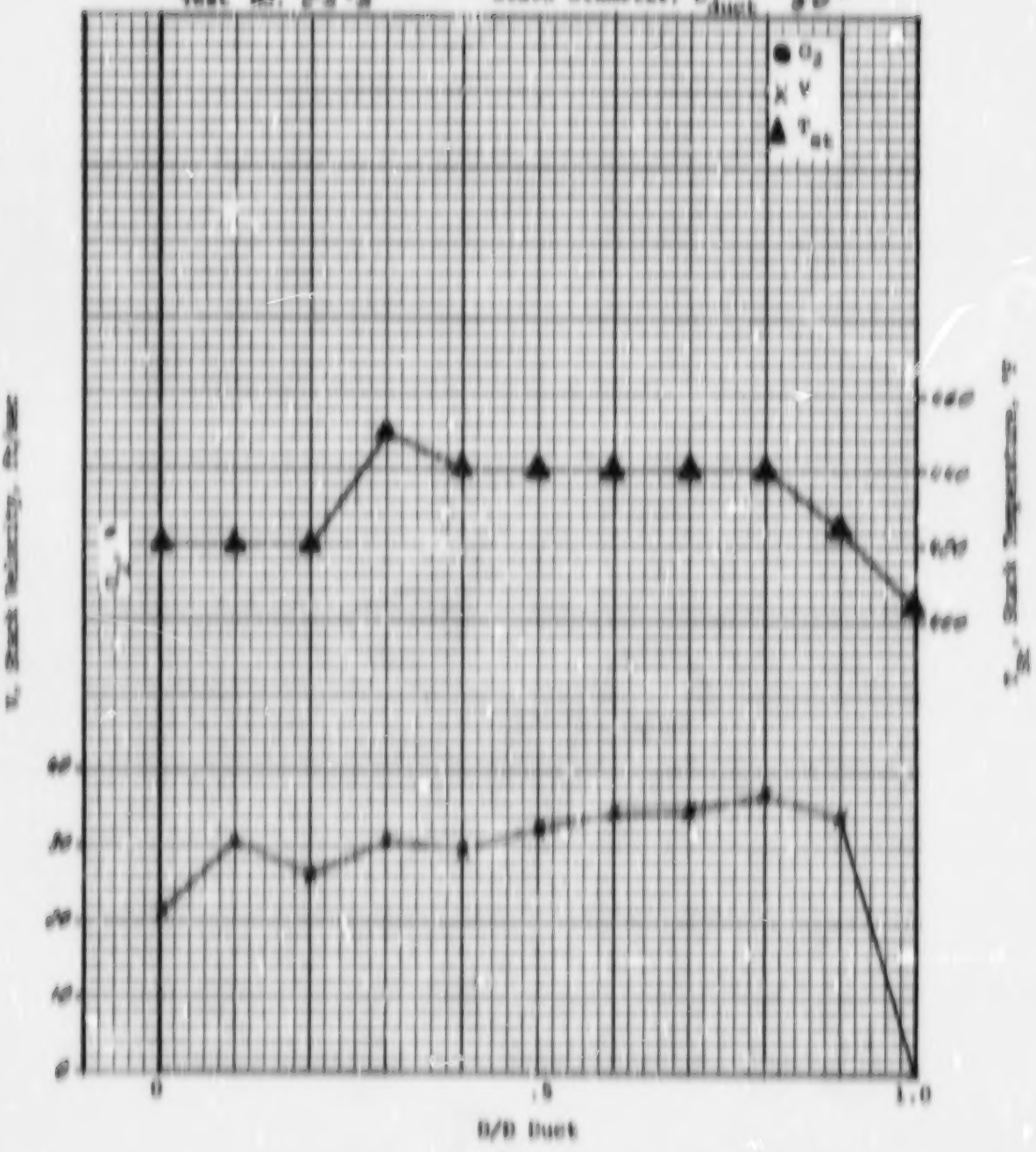
Test No.	12E-8	12E-9	12E-10	12E-11	12E-12	12E-13	12E-14
Test Type	Comb Air	Comb Air	Comb Air	Excess Air	Comb Air	Comb Air	Ref Air
Test Load (10^3 lb/hr)	120	120	115	115	120	115	110
Excess O_2 (%)	11.4	10.8	10.8	13.1	10.0	11.1	14.5
NO_x (ppm) #	249	249	214	330	318	268	219
NO (ppm) #	243	249	212	326	316	268	201
$(O)_2$ dry (%)	5.0	5.2	4.4	5.6	4.8	4.9	3.2
CO (ppm) #	38	35	41	43	50	18	47
HC (ppm) #	27	26	31	27	53	52	88
SO_x (ppm) #							
SO_2 (ppm) #							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		82					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	2400	2386	2390	2398	2396	2385	2395
Final Stm Temp. (°F)	1000	997	1000	1000	1000	1000	1000
Combus. Air Temp. (°F)	315	315	310	309	303	299	303
Stack Temp. (°F)	360	360	350	360	349	338	325
Fuel Flow (MCF/hr)	118	118	107	107	107	107	107
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	0.036	0.036	0.033	0.033	0.033	0.033	0.033
Furnace Pres. (in.H_2O)	-0.15	-0.10	-0.15	-0.10	-0.10	-0.10	-0.10
Register (% open)	100	100	100	100	100	100	100

@ 3% O_2 dry

STACK TRAVERSE DATA

Location No. 6
Unit No. 3
Test No. 25-6

Fuel Nat. Gas
Load 132,000 lb/hr
Stack Diameter, D_{duct} 60"



Location 6
Unit 3
Test No. 05

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	86.0	13.9	1100
5	.0	0	.1	86.0	13.9	1100
12	.0	0	.1	86.0	13.9	1100
13	.0	0	.1	86.0	13.9	1100
14	0	.0	0.6	76.0	80.6	1129
17	0	.0	0.6	76.0	80.6	1129
24	0	.0	0.6	76.0	80.6	1129
25	.0	0	.1	86.0	13.9	1100
30	0	.0	0.6	76.0	80.6	1129
37	.0	0	.1	86.0	13.9	1100
38	.0	0	.1	86.0	13.9	1100
39	.0	.0	0.1	86.0	3.6	984
40	.0	0	0.0	86.0	0	966
41	.0	0	.1	86.0	13.9	1100
47	.0	0	0.0	86.0	0	966
48	.0	.0	0.1	86.0	3.6	984
49	.0	0	0.4	84.1	6.7	967
58	.0	0	.1	86.0	13.9	1100
60	.0	0	.1	86.0	13.9	1100
67	.0	0	.1	86.0	13.9	1100
69	.0	0	.1	86.0	13.9	1100
76	0.0	0	1.0	85.0	88.7	1048
77	0.0	0	1.0	85.0	88.7	1048
80	0	.0	0.6	76.0	80.0	1129

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 6

Unit 3

Fuel #2 oil

Test No.	6B-1	6B-2	6B-3	6B-4	6B-5	6B-6	6B-7
Test Type	Base	M. closed	Excess Air	Low closed	M Air	M Air	M Air
Test Load (10^3 lb/hr)	115	100	100	80	115	120	120
Excess O_2 (%)	5.6	4.8	6.8	8.4	10.8	8.4	6.0
NO_x (ppm)*	185	269	191	121	275	266	223
NO (ppm)*	200	281	185	126	279	268	230
CO_2 dry (%)	7.7	8.6	7.8	6.4	9.6	11.0	11.2
CO (ppm)*	11	11	10	10	10	12	12
HC (ppm)*	110	105	70	64	110	39	30
SO_x (ppm)*	107						
SO_2 (ppm)*	98						
Total Part. (lb/MMBtu)	0.0090						
Solid Part. (lb/MMBtu)	0.0087						
Boiler Efficiency (%)	84	85		84			
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	275	278	280	280	275	290	285
Final Stm Temp. (°F)	605	605	605	600	600	600	600
Combus. Air Temp. (°F)	80	81	79	78	78	78	78
Stack Temp. (°F)	355	345	340	325	299	290	270
Fuel Flow gal/hr	795	820	831	829			
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	94	96	95	97	98	99	99
Furnace Pres. (in. H_2O)	-.6	-.8	-.8	-.8	-.8	-.8	-.8
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

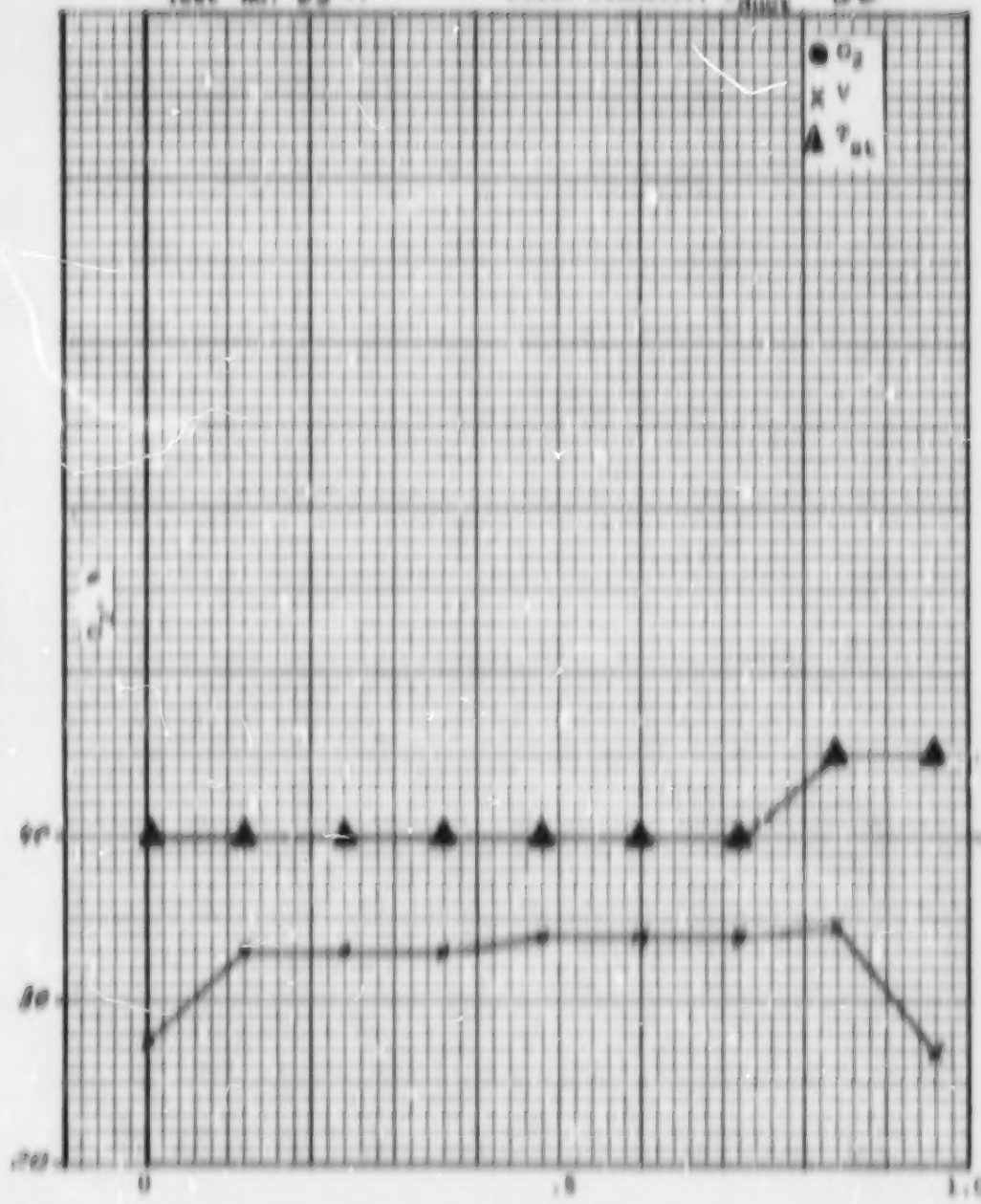
Barbizon Smoke No.

STACK TRAVERSE DATA

Location No. 6 Fuel #2 Oil

Unit No. 3 Load 115,000 lb/hr

Test No. 65-1 Stack Diameter, D_{duct} 60"



REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

5101 N. FIGUEROA STREET
LOS ANGELES 90042
AREA CODE 213 · 256-1064
CABLE: TRUELAB

CLIENT: EVS Engineering
17332 Irvine Boulevard
Tustin, California 92680

SAMPLE: Attention: Mr. Glenn Cato

3 oil samples - EPA 68-60

P.O. No. 1700-43

INVESTIGATION: Analyses and tests as requested
Locations 6
Unit 3
Test No. 65

DATE: February 27, 1974
RECEIVED: February 4, 1974
LABORATORY NO. 120913

RESULTS

Sample Identification:

No. 1 — Unit #3, Test #65-1, January 3, 1974

	No. 1
Carbon, %	86.09
Hydrogen, %	13.14
Nitrogen, %	0.018
Ash, %	0.005
Carbon Residue, % (Conradson)	0.066
API Gravity at 20°C	33.4
Viscosity at 40°C, SSU	35

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

A. W. Palmer, M.S.
Chief Chemist

INDUSTRIAL BOILER DESIGN DATA

Location No. 7 Test No. 6 Unit No. 3

Unit Description B&W steam generator, Contract 1-1735

Installation Date	1960
Steam Output (10^3 lb/hr)	85
Design Pressure (psig)	300
Final Steam Temp (°F)	420
Furnace Type	Watertube
Furnace Size L-W-H (ft)	14 - 14 - 8
Furnace Area (ft^2)	840
Furnace Volume (ft^3)	1570
Burner Description	4 B&W steam atom. oil guns
Horiz. Burner Spacing (ft)	2' 1"
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	172
Primary Air Temp (°F)	~240
Stack Temp (°F)	~490

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location ?

Unit 3

Fuel #6 @ ?

Test No.	6-1	6-2	6-3	6-4	6-5	6-6	6-7
Test Type	Adjust Air	Normal	Adjust Air	----------	Low Load	Base	Adjust Air
Test Load (10^3 lb/hr	62.5	86	97	40	23	59	60
Excess O_2 (%)	6.5	4.7	9.2	----------	14.5	7.6	7.9
NO_x (ppm)*	297	327	342	----------	366	329	339
NO (ppm)*	315	351	362	----------	390	348	358
CO_2 dry (%)	10.6	12.8	9.0	----------	6.2	10.2	12.2
CO (ppm)*	50	44	46	----------	97	27	27
HC (ppm)*	19	18	23	----------	29	18	29
SO_x (ppm)*	----------	----------	----------	----------	----------	----------	----------
SO_2 (ppm)*	----------	----------	----------	----------	----------	----------	----------
Total Part. (lb/MBtu)	----------	----------	----------	----------	----------	----------	----------
Solid Part. (lb/MBtu)	----------	----------	----------	----------	----------	----------	----------
Boiler Efficiency (%)	----------	83	----------	----------	77	86	----------
Smoke Spot No.	----------	----------	----------	----------	----------	----------	----------
Opacity (%)	----------	----------	----------	----------	----------	----------	----------
Final Stm Pres. (psig)	1340	1348	1343	1330	1322	1335	1337
Final Stm Temp. (°F)	900	904	902	895	890	897	897
Combus. Air Temp. (°F)	240	240	240	240	240	----------	----------
Stack Temp. (°F)	270	315	280	270	275	285	289
Fuel Flow gal/min	8.8	11	9.7	0	5.7	7.6	7.9
Fuel Temp. (°F)	190	190	190	190	190	190	190
Fuel Pres. (psig)	85	97	88	80	6	90	80
Furnace Pres. (in. H_2O)	-0.18	-0.18	-0.17	-0.17	-0.15	-0.17	-0.17
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location P

Unit 3

Fuel # 6 @ 1

Test No.	6-8	6-9	6-10	6-11	6-12	6-13	6-14
Test Type	Normal Air	Less Air	Less Air	Normal Air	Less Air	Less Air	Less Air
Test Load (10^3 lb/hr)	60	56	55	44	43	39.5	42
Excess O_2 (%)	2.6	0.8	0.4	10.3	0.6	1.0	0.6
NO_x (ppm)*	336	286	258	100	289	252	243
NO (ppm)*	358	309	271	338	308	270	261
CO_2 dry (%)	10.0	11.0	11.0	6.0	6.0	9.4	7.6
CO (ppm)*	27	24	23	33	29	27	25
HC (ppm)*	29	20	14	20	16	16	15
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	234	241	244	232	217	220	237
Final Stm Temp. (°F)	397	400	404	396	398	397	400
Combus. Air Temp. (°F)							
Stack Temp. (°F)	290	290	280	275	270	265	270
Fuel Flow gal/min	7.1	7.1	7.1	6	6.9	6.8	6.50
Fuel Temp. (°F)	178	178	178	178	178	178	178
Fuel Pres. (psig)	80	80	80	80	10	10	10
Furnace Pres. (in. H_2O)	-0.17	-0.15	-0.15	-0.14	-0.21	-0.17	-0.16
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location ?

Unit 8

Fuel #6 Oil

Test No.	6-15	6-16	6-17	6-18	6-19	6-20	6-21
Test Type	11% Air	10% Air	Low Air	#4 Burner	#6 Burner	#4 Burner	#6 Burner
Test Load (10^3 lb/hr)	44	58	57	37.5	51	30	30
Excess O_2 (%)	10.9	7.8	4.6	11.6	8.1	15.5	12.9
NO_x (ppm)*	340	341	247	337	220	344	338
NO (ppm)*	308	258	268	345	234	304	342
CO_2 dry (%)	7.6	10.2	12.0	7.2	9.6	6.2	8.4
CO (ppm)*	116	26	22	19	28	131	44
HC (ppm)*	21	21	19	34	20	61	45
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			84				
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	240	244	243	240	240	237	237
Final Stm Temp. (°F)	400	402	402	396	400	398	396
Combus. Air Temp. (°F)		240	240	240	242	240	240
Stack Temp. (°F)	276	285	287	275	280	268	270
Fuel Flow gal/min	5.5	7.0	7.0	4.2	6.7	3.1	3.9
Fuel Temp. (°F)	174	172	170	170	172	170	169
Fuel Pres. (psig)	100	80	80	100	85	5	10
Furnace Pres. (in. H_2O)	-0.14	-0.17	-0.17	-0.10	-0.17	-0.15	-0.12
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 7

Unit 3

Fuel #6 Oil

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	#4 Boots	#2 Boots	#0 Boots	#0 Boots	#3 Boots	#0 Boots	#1 Boots
Test Load (10^3 lb/hr)	39.5	40.2	40	40	41.5	41.5	40
Excess O_2 (%)	11.5	8.8	9.4	11.8	8.4	8.4	8.8
NO_x (ppm)*	310	214	219	216	247	213	206
NO (ppm)*	302	210	263	263	240	213	205
$(O)_2$ dry (%)	7.4	9.4	8.8	8.2	9.5	9.4	9.5
CO (ppm)*	37	28	31	33	43	43	28
HC (ppm)*	36	18	19	20	28	23	21
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)					81		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	250	250	250	250	250	250	250
Final Stm Temp. (°F)	396	404	407	406	400	400	400
Combus. Air Temp. (°F)	240	245	240	245	240	240	240
Stack Temp. (°F)	260	275	278	278	280	285	282
Fuel Flow gal/min	5	5.3	5.3	5.3	6.0	6.0	5.8
Fuel Temp. (°F)	178	176	174	174	170	170	170
Fuel Pres. (psig)	24	24	24	24	30	30	30
Furnace Pres. (in. H_2O)	-0.12	-0.18	-0.12	-0.15	-0.12	-0.12	-0.15
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 7

Unit 8

Fuel #6 Oil

Test No.	6-29	6-30	6-31	6-32	6-33	6-34	6-35
Test Type	#1 Boots	#1 Boots	#1 Boots	#1 Boots	#1 Boots	#1 Boots	#1 Boots
Test Load (10^3 lb/hr)	399	400	390	405	390	400	400
Excess O_2 (%)	16.5	15.3	14.8	8.0	16.3	15.9	15.3
NO_x (ppm)*	294	341	337	245	290	304	318
NO (ppm)*	290	333	332	248	308	331	324
O_2 dry (%)	3.9	4.6	5.4	7.2	3.8	4.4	6.0
CO (ppm)*	34	1500	80	20	33	64	41
HC (ppm)*	25	47	28	16	20	37	22
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	2440	2440	2440	2458	2442	2441	2443
Final Stm Temp. (°F)	600	600	600	607	601	601	601
Combus. Air Temp. (°F)	240	248	240	242	245	242	242
Stack Temp. (°F)	367	367	370	380	380	375	375
Fuel Flow Gal/min	6.6	6	6.5	6.0	6.7	6.1	6.5
Fuel Temp. (°F)	170	170	170	170	170	170	170
Fuel Pres. (psig)	230	5	10	5.0	230	5	10
Furnace Pres. (in. H_2O)	-0.18	-0.16	-0.16	-0.17	-0.16	-0.16	-0.16
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location ?

Unit 3

Fuel #6 Oil

Test No.	6:30	6:37	6:38	6:39	6:40	6:41	6:42
Test Type	#3 Boiler	#3 Boiler	#3 Boiler	#3 Boiler	#3 Boiler	#3 Boiler	#3 Boiler
Test Load (10^3 lb/hr)	69	62	62	61	61	41	61
Excess O_2 (%)	6.0	7.7	15.5	10.3	11.0	8.1	10.8
NO_x (ppm)*	174	212	196	400	323	248	314
NO (ppm)*	174	210	196	408	322	240	278
$(O)_2$ dry (%)	11.4	11.2	9.6	6.6	7.8	10.0	9.6
CO (ppm)*	24	27	72	54	36	28	1891
HC (ppm)*	7	16	41	37	26	21	69
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	230	242	242	239	240	242	240
Final Stm Temp. (°F)	396	400	400	400	400	400	400
Combus. Air Temp. (°F)	290	295	230	240	200	245	240
Stack Temp. (°F)	285	277	275	296	275	285	282
Fuel Flow (bbl/min)	10.5	9.3	9.3	9.3	9.3	8.2	8.2
Fuel Temp. (°F)	178	178	178	178	178	178	178
Fuel Pres. (psig)	50	43	43	44	44	45	45
Furnace Pres. (in.H_2O)	-0.17	-0.17	-0.21	-0.18	-0.17	-0.17	-0.28
Register (% open)	100	100	100	100	100	100	100

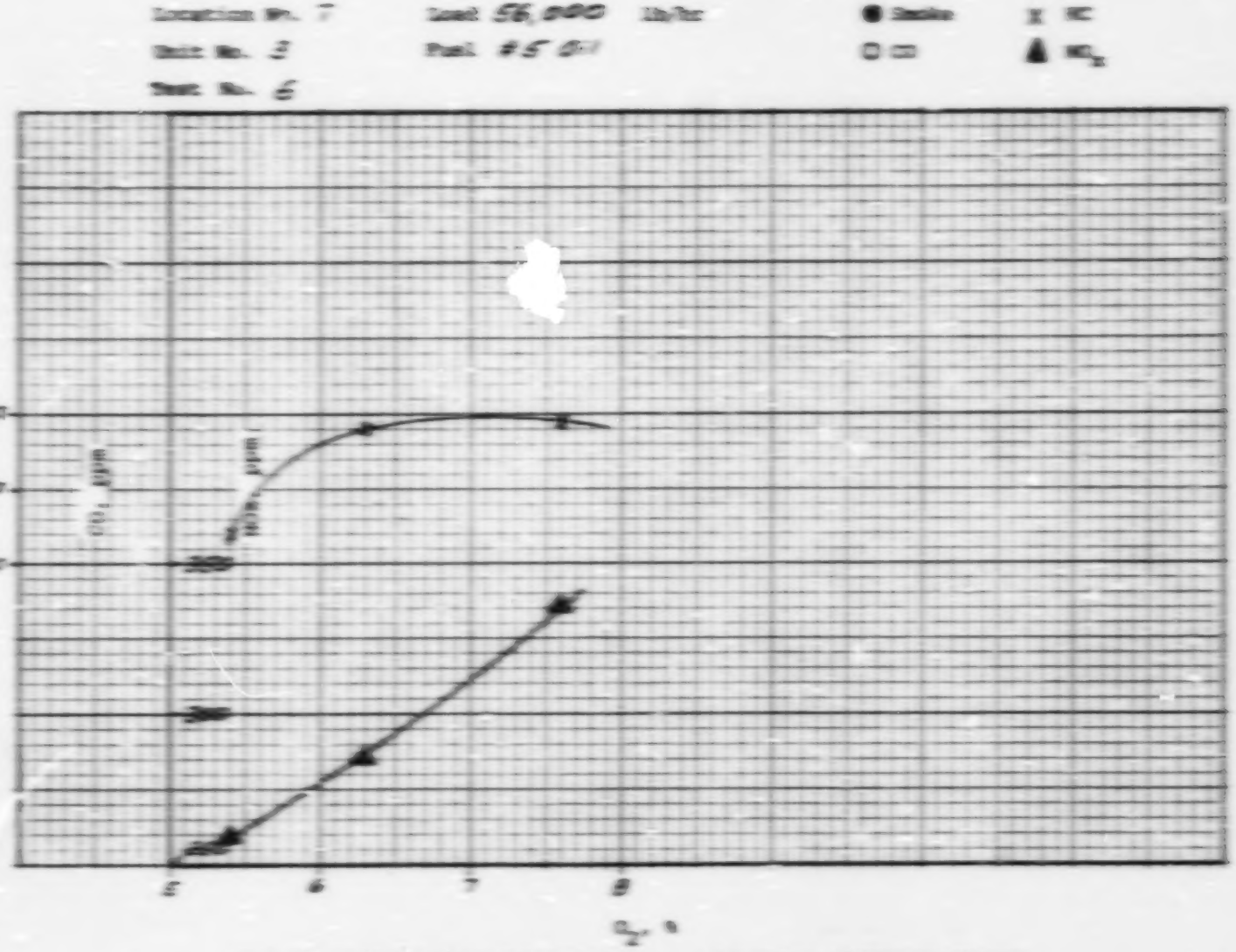
*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 7
Unit 3
Fuel #6 Oil

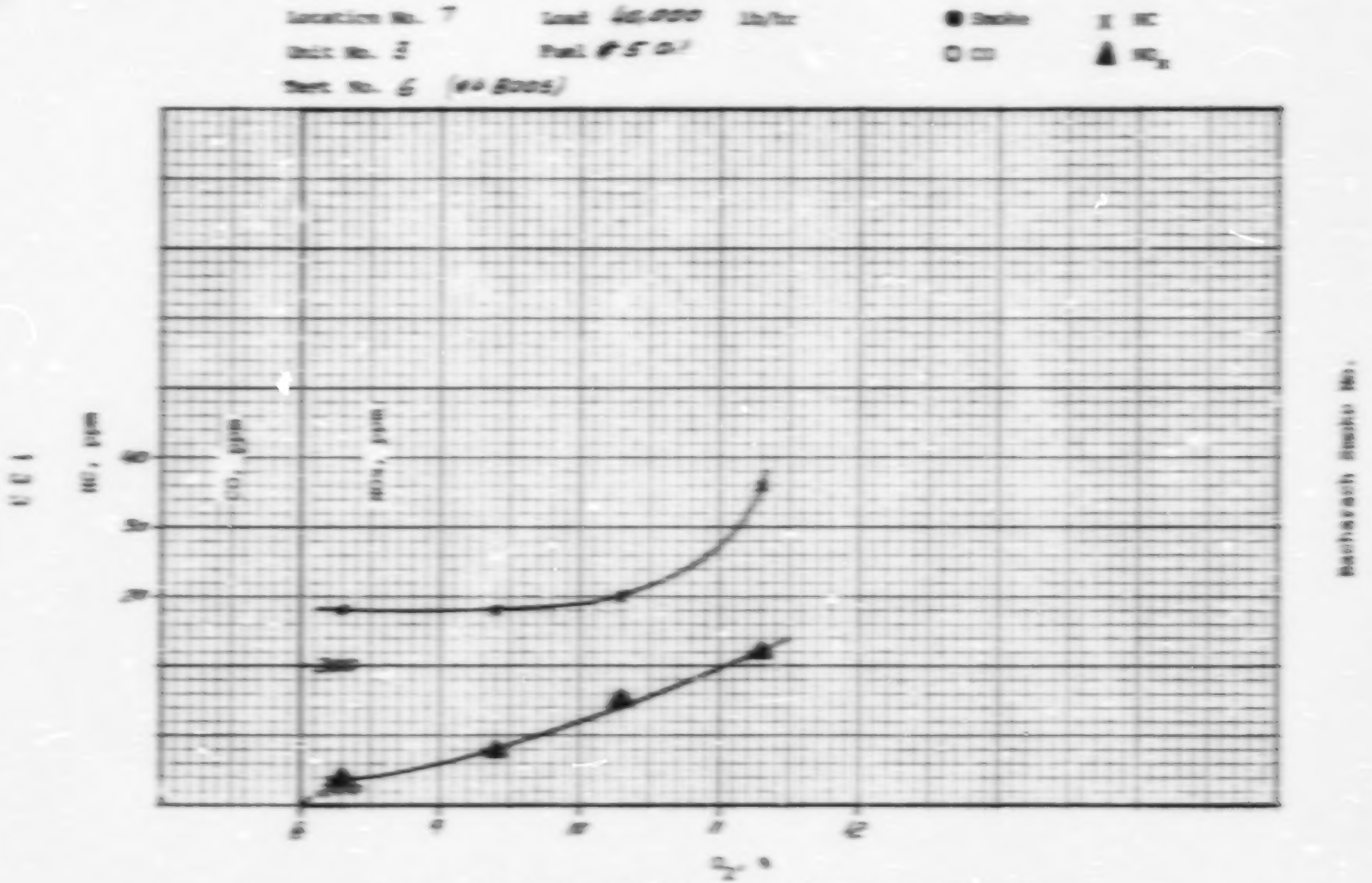
Test No.	6-93	6-94					
Test Type	#1 Stack	#1 Stack					
Test Load (10^3 lb/hr)	41	41					
Excess O_2 (%)	9.5	13.0					
NO_x (ppm)*	284	360					
NO (ppm)*	284	355					
O_2 dry (%)	10.2	6.4					
CO (ppm)*	23	90					
HC (ppm)*	16	19					
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	540	540					
Final Stm Temp. (°F)	490	490					
Combus. Air Temp. (°F)	105	100					
Stack Temp. (°F)	285	280					
Fuel Flow Gal/min.	5.2	5.2					
Fuel Temp. (°F)	172	170					
Fuel Pres. (psig)	25	25					
Furnace Pres. (in. H_2O)	-0.12	-0.11					
Register (% open)	100	100					

*at 3% O_2 dry



Emissions for Industrial Boilers as a Function of Excess Oxygen

Research Cottrell No.



Emissions for Industrial Boilers as a Function of Excess Oxygen

Bacteriocin Stocks (No.

Reductions for Industrial Boilers as a Function of Dissolved Oxygen

O_2, ppm

ppm, CO_2

ppm, H_2S

Reactions for Industrial Boilers as a Function of Excess Oxygen

135

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

5161 N. FIGUEROA STREET
LOS ANGELES 90042
AREA CODE 213 · 255-1064
CABLE: TRUELABS

SUBMITTED BY: KVB Engineering
17332 Irvine Boulevard
Tustin, California 92680

SAMPLED: Attention: Mr. Glenn Cato

3 oil samples - EPA SR-60

P.O. No. 1700-43

INVESTIGATION: Analyses and tests as requested

DATE: February 27, 1974

RECEIVED: February 4, 1974

LABORATORY NO. 120913

Specimen 2
Unit 3
Test No 6

RESULTS

Sample identification:

Boiler #3, Test No. 6, January 8, 1974

	No. 2
Carbon, %	85.65
Hydrogen, %	12.06
Nitrogen, %	0.32
Ash, %	0.010
Carbon Residue, % (Conradson)	3.27
API Gravity at 20°C	31.0
Viscosity at 40°C, SSU	230

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

A. W. Bahner, M.S.
Chief Chemist

INDUSTRIAL BOILER DESIGN DATA

Location No. 8 Test No. 23, 24 Unit No. A

Unit Description B&W steam generator

Installation Date	1964
Steam Output (10^3 lb/hr)	110
Design Pressure (psig)	250
Final Steam Temp (°F)	450
Furnace Type	Waterwalls
Furnace Size L-W-H (ft)	15 · 16 · 21
Furnace Area (ft^2)	1782
Furnace Volume (ft^3)	5040
Burner Description	11 Peerless Type 4-30 Gas & Steam atom. Oil Burners
Horiz. Burner Spacing (ft)	4'
Vert. Burner Spacing (ft)	3'
Test Fuel	#6 Oil & 8% Refinery Gas
Fuel Temp at Burner (°F)	~240
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~590

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location B

Unit #8

Fuel #6 Oil & 8% Refinery Gas

Test No.	28-1	28-2	28-3	28-4	28-5	28-6	28-7
Test Type	Base	Hi Comb	40% Excess Air	40% Excess Air	40% Excess Air	Close Damper	40% Excess Air
Test Load (10^3 lb/hr)	88.4	91	70.2	57.8	93.1	87	88.4
Excess O_2 (%)	3.0	2.3	0.5	9.7	10.5	15.5	7.8
NO_x (ppm)*	178	189	209	209	202	190	209
NO (ppm)*	170	189	211	218	208	177	209
$(NO)_2$ dry (%)	4.8	4.7	3.8	7.0	7.4	5.0	4.6
CO (ppm)*	28	20	29	32	48	96	27
HC (ppm)*	39	31	40	23	22	28	28
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	77	76				83	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	825	828	815	810	805	800	817
Final Stm Temp. (°F)	950	950	950	950	950	950	950
Combus. Air Temp. (°F)	Ambient						
Stack Temp. (°F)	598	600	559	539	506	467	600
Fuel Flow							
Fuel Temp. (°F)	260	260	260	260	260	260	260
Fuel Pres. (psig)	68	70	62	40	82	78	74
Furnace Pres. (in. H_2O)	-0.4	-0.3	-0.3	-0.8	-0.8	-0.8	-0.3
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL, NOXN DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
SO_x (ppm)[a]					[illegible]		
SO_2 (ppm)[a]					[illegible]		
Total Part. (lb/MBtu)					[illegible]		
Solid Part. (lb/MBtu)					[illegible]		
Boiler Efficiency (%)			[illegible]				
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Combus. Air Temp. (°F)	[illegible]				"		
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Flow							
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

[a] at 3% O_2 dry

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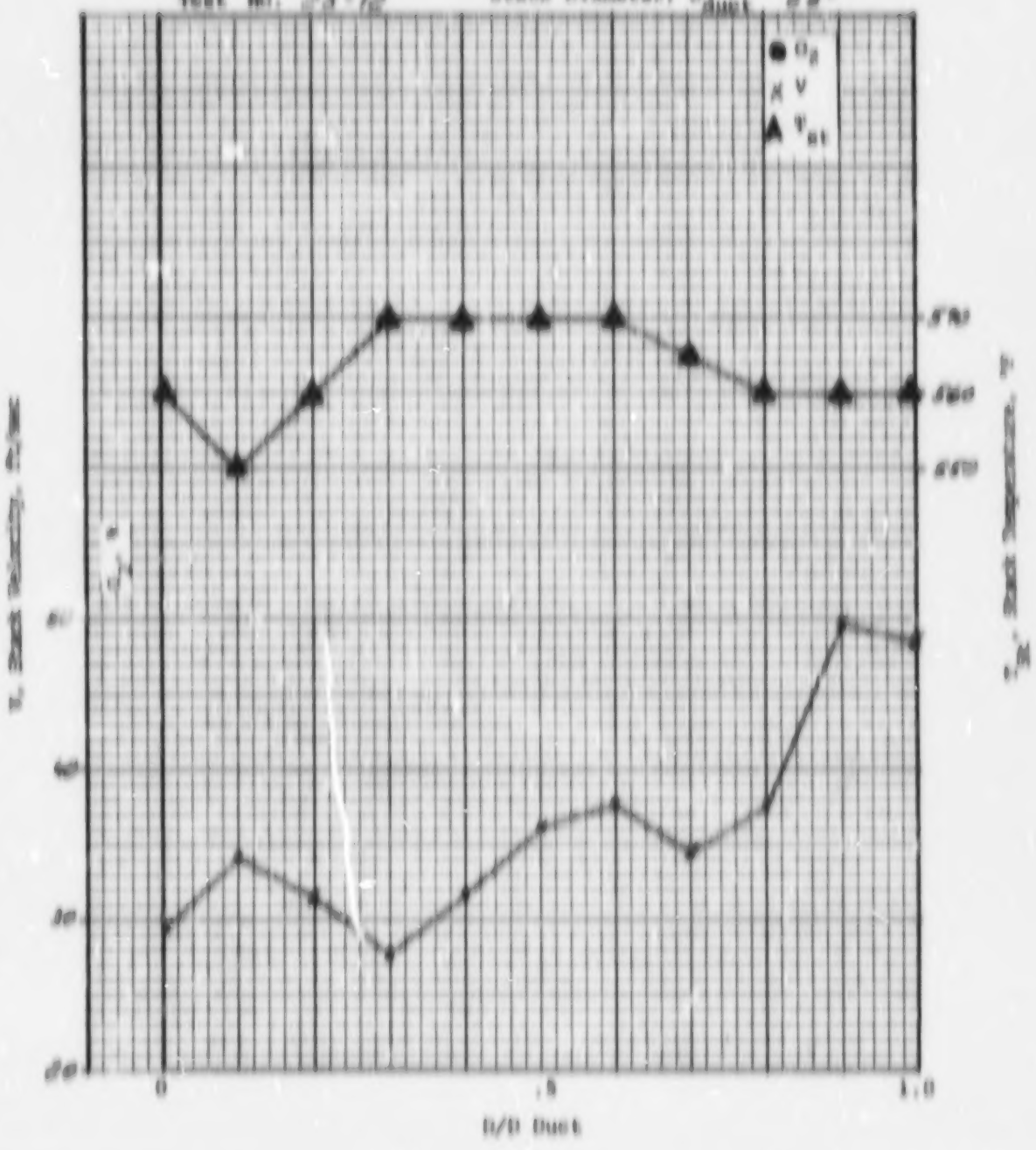
STACK TRAVERSE DATA

Location No. [illegible]
Unit No. [illegible]
Test No. [illegible]

Fuel #6 oil of Refinery Gas
Load [illegible] lb/hr
Stack Diameter, D_{Duct} [illegible]



BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr							
Excess O_2 (%)							
NO_x (ppm)*							
HC (ppm)*							
$(X)_x$ dry (%)							
CO (ppm)*							
HCl (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Bacho Spot No.							
Opacity (%)							
Final Stm Prss. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Press. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

RUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 · 225-1064
CABLES: TRUELAB

CLIENT	KVB Engineering 17332 Irvine Boulevard Tustin, California 92680	DATE	February 27, 1974
		RECEIVED	February 4, 1974
FILE	Attention: Mr. Glenn Cato	LABORATORY NO.	130913
	3 oil samples - EPA SR-60		
J. No.	1700-43		
INVESTIGATION	Analyses and tests as requested Locations # Unit #10 Test #28, 29		

RESULTS

Sample identification:

No. 3 Boiler #10, Test #29, January 11, 1974

	No. 3
Carbon, %	85.83
Hydrogen, %	13.22
Nitrogen, %	0.16
Ash, %	0.017
Carbon Residue, % (Conradson)	3.26
API Gravity at 30°C	30.0
Viscosity at 40°C, SSU	378

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

A. M. Kaliner, M.S.
Chief Chemist

INDUSTRIAL BOILER DESIGN DATA

Location No. 9 Test No. 15 Unit No. BC-1

Unit Description 80 MW Integral Furnace

Installation Date	1978
Steam Output (10^3 lb/hr)	80
Design Pressure (psig)	860
Final Steam Temp (°F)	930
Furnace Type	Waterwalls
Furnace Size L-W-H (ft)	18 · 10 · 19
Furnace Area (ft^2)	1020
Furnace Volume (ft^3)	3420
Burner Description	4 80 MW Ring Burners
Horiz. Burner Spacing (ft)	8
Vert. Burner Spacing (ft)	2'6"
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	~400
Stack Temp (°F)	~360

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(X)_x$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(X) (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]							
SO_x (ppm)[a]							
SO_2 (ppm)[a]							
Total Part. (lb/MBtu)	[illegible]						
Solid Part. (lb/MBtu)	[illegible]						
Boiler Efficiency (%)	[illegible]		[illegible]			[illegible]	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	Ambient						→
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]
Unit [illegible]
Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]							
SO_x (ppm)[a]							
SO_2 (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	[illegible]				[illegible]		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow ([illegible])	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in.H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a]at 3% O_2 dry

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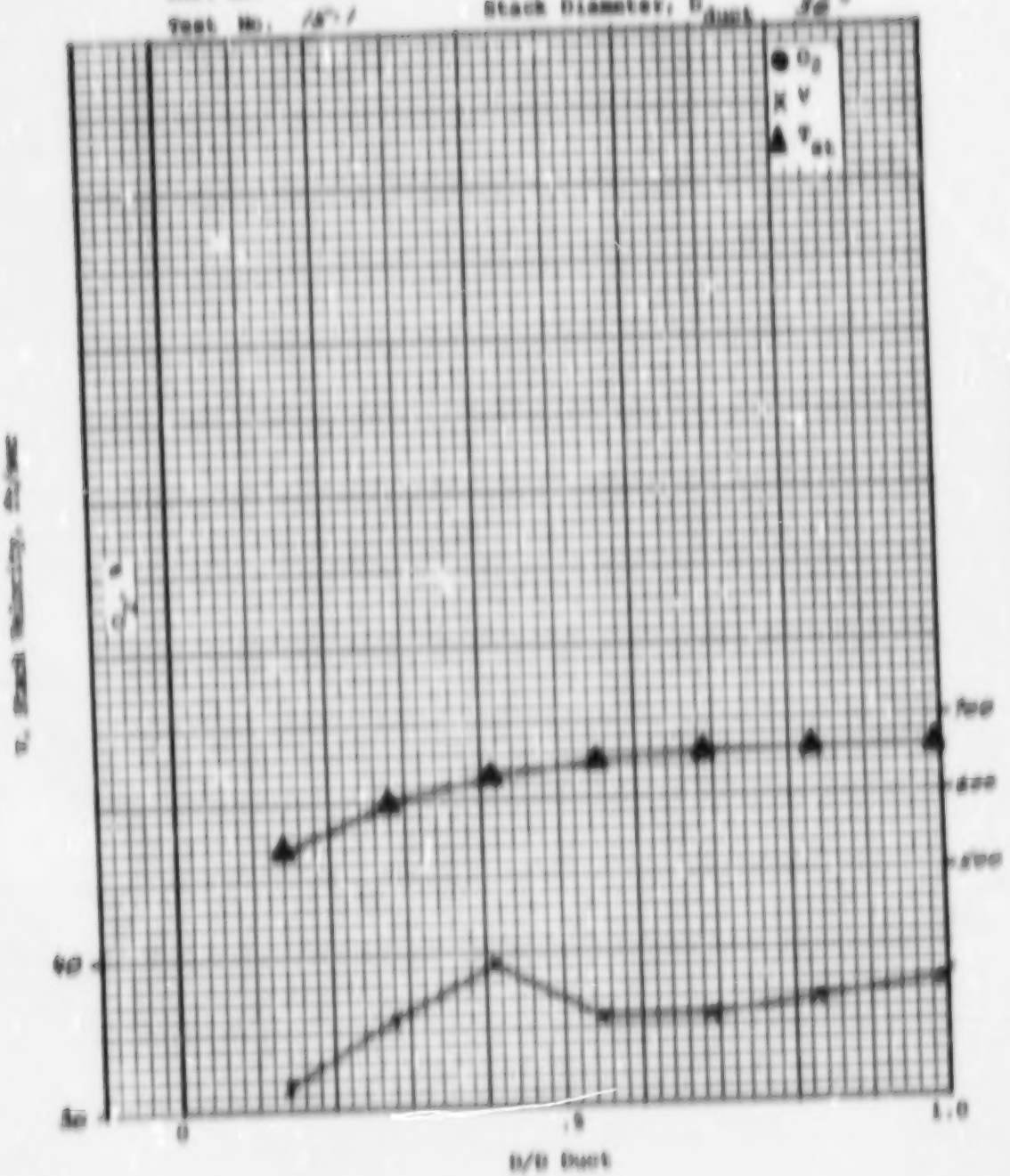
STACK TRAVERSE DATA

Location No. 9
Unit No. 8C-1
Test No. 15-1

Fuel Ash/Coal
Load 648, 650#
Stack Diameter, D_{duct} 84"

lb/hr



INDUSTRIAL BOILER DESIGN DATA

Location No. 9 Test No. 29 Unit No. BC-6

Unit Description Riley Integral Furnace, Model 100

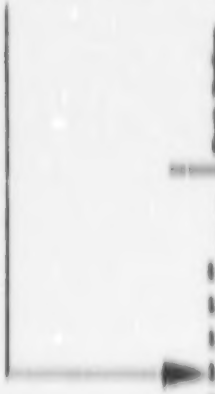
Installation Date	1900
Steam Output (10^3 lb/hr)	100
Design Pressure (psig)	600
Final Steam Temp (°F)	320
Furnace Type	Watertube
Furnace Size L-W-H (ft)	15' 10' 27'
Furnace Area (ft^2)	1700
Furnace Volume (ft^3)	6000
Burner Description	3 Coppus Roll Burner Model 70" with tangential air zones.
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Hvit coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	~ 300
Stack Temp (°F)	

Comments:

Locations 9
Unit #C-1
Test No. 15

FUEL ANALYSIS SUMMARY

Gas Fuel



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	80.0	19.0	1100
5	.0	0	.1	80.0	19.0	1100
13	.0	0	.1	80.0	19.0	1100
14	.0	0	.1	80.0	19.0	1100
16	0	.0	0.0	76.0	20.0	1120
17	0	.0	0.0	76.0	20.0	1120
24	0	.0	0.0	76.0	20.0	1120
25	.0	0	.1	81.0	19.0	1100
26	0	.0	0.0	76.0	20.0	1120
27	.0	0	.1	80.0	19.0	1100
28	.0	0	.1	80.0	19.0	1100
29	.0	.0	0.0	80.0	3.0	984
46	.0	0	3.0	96.0	0	966
47	.0	0	.1	80.0	19.0	1100
47	.0	0	3.0	96.0	0	966
48	.0	.0	0.0	80.0	3.0	984
49	.0	0	0.0	90.1	6.7	987
58	.0	0	.1	80.0	19.0	1100
60	.0	0	.1	80.0	19.0	1100
67	.0	0	.1	80.0	19.0	1100
68	.0	0	.1	80.0	19.0	1100
76	0.0	0	1.0	85.0	80.7	1040
77	0.0	0	1.0	81.0	80.7	1040
66	0	.0	0.0	76.0	20.0	1120

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 9

Unit 8C - 6

Fuel 4611 Coal

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible] Air	M steam	Mass	Low excess	[illegible] Air	Low Air	Low Air
Test Load (10^3 lb/hr)	188	189	186	137	134	134	128
Excess O_2 (%)	3.8	3.5	3.8	4.0	3.6	3.8	4.6
NO_x (ppm)*	402	404	374	315	380	377	389
NO (ppm)*	384	385	356	298	362	359	368
O_2 dry (%)	12.0	11.8	9.8	7.8	11.0	10.4	9.8
CO (ppm)*	79	98	63	40	92	78	59
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)	0.0065						
Solid Part. (lb/MBtu)	0.0042						
Boiler Efficiency (%)		83	86	83			85
Smoke Spot No.							
Opacity (%)							
Final Stm Press. (psig)	804	815	812	810	812	812	810
Final Stm Temp. (°F)	915	910	910	910	910	910	910
Combus. Air Temp. (°F)	350	340	330	325	320	320	320
Stack Temp. (°F)							
Fuel Flow [illegible]	148	138	140	110	100	100	100
Fuel Temp. (°F)	Ambient						
Fuel Press. (psig)	60	70	60		60	60	50
Furnace Press. (in. H_2O)	0	0	0.5	0.0	0	0	0
Register (% open)	60 · 100 · 60	60 · 100 · 60	60 · 100 · 60	60 · 100 · 60	60 · 100 · 60	60 · 100 · 60	60 · 100 · 60

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 9

Unit #6 - 6

Fuel Mill Gas

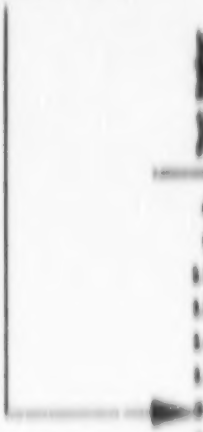
Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
$(\%)_2$ dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (lb/hr)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

Locations 9
Shelf BC-6
Test No. 24

FUEL ANALYSIS SUMMARY

Gas Fuel



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	85.6	13.1	1160
5	.0	0	.1	86.0	13.0	1160
12	.0	0	.1	86.0	13.0	1160
13	.0	0	.1	86.0	13.0	1160
14	0	.0	6.0	74.0	20.0	1130
15	0	.0	6.0	74.0	20.0	1130
24	0	.0	6.0	74.0	20.0	1130
25	.0	0	.1	85.0	13.1	1161
26	0	.0	6.0	74.0	20.0	1130
27	.0	0	.1	85.0	13.0	1160
28	.0	0	.1	85.0	13.0	1160
29	.0	.0	0.2	98.9	0.4	984
40	.0	0	1.0	99.0	0	988
41	.0	0	.1	85.0	13.0	1160
47	.0	0	1.0	99.0	0	988
48	.0	.0	0.2	98.9	0.4	984
49	.0	0	0.4	99.1	0.7	987
58	.0	0	.1	85.0	13.0	1160
60	.0	0	.1	85.0	13.0	1160
67	.0	0	.1	85.0	13.0	1160
69	.0	0	.1	85.0	13.0	1160
76	0.0	0	1.0	93.0	86.7	1068
77	0.0	0	1.0	93.0	86.7	1068
80	0	.0	6.0	74.0	20.0	1130

INDUSTRIAL BOILER DESIGN DATA

Location No. 7 Test No. 40 Unit No. 1A : 1

Unit Description B&W Integral Furnace, Serial NP PP1-2188

Installation Date	1971
Steam Output (10^3 lb/hr)	300
Design Pressure (psig)	900
Final Steam Temp (°F)	850
Furnace Type	Water tube
Furnace Size L-W-H (ft)	36 : 22 : 16
Furnace Area (ft^2)	3800
Furnace Volume (ft^3)	11670
Burner Description	4 B&W Ring Burners, Size 30" ϕ
Horiz. Burner Spacing (ft)	7
Vert. Burner Spacing (ft)	7
Test Fuel	Coal Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	~ 400
Stack Temp (°F)	~ 280

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit VA-1

Fuel [illegible] Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible] Air	[illegible] Air	[illegible] Air	[illegible] Air	[illegible] Air	[illegible] Air	[illegible] Air
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	184	184
Excess O_2 (%)	3.2	[illegible]	[illegible]	3.2	[illegible]	2.9	2.9
NO_x (ppm)*	181	154	194	166	171	192	195
NO (ppm)*	181	154	187	166	168	192	188
CO_2 dry (%)	10.1	9.9	8.9	10.2	10.4	10.2	10.6
CO (ppm)*	0	0	0	0	24	10	97
HC (ppm)*	3	3	0	2	20	0	9
SO_x (ppm)*	———	———	———	———	———	———	———
SO_2 (ppm)*	———	———	———	———	———	———	———
Total Part. (lb/MBtu)	[illegible]	———	———	———	———	———	———
Solid Part. (lb/MBtu)	[illegible]	———	———	———	———	———	———
Boiler Efficiency (%)	———	———	———	———	———	———	———
Smoke Spot No.	———	———	———	———	———	———	———
Opacity (%)	———	———	———	———	———	———	———
Final Stm Pres. (psig)	811	812	812	812	812	812	812
Final Stm Temp. (°F)	559	559	559	559	559	559	559
Combus. Air Temp. (°F)	401	401	401	401	401	401	374
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (MSCFH)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	198	198
Fuel Temp. (°F)	Ambient						—
Fuel Pres. (psig)	[illegible]	11.8	9.5	9.8	9.8	8.8	8.8
Furnace Pres. (in.H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location *9*

Unit *VA-1*

Fuel *Natural Gas*

Test No.	30-8	30-9	30-10	30-11	30-12	30-13	30-14
Test Type	M Air	M Air	Modified Air	M Excess	M Air	Modified Air	Baseline
Test Load (10^3 lb/hr)	189	189	185	280	278	193	259
Excess O_2 (%)	4.3	5.0	2.9	4.0	4.3	2.7	3.1
NO_x (ppm)*	200	195	198	———	215	182	205
NO (ppm)*	200	195	198	———	212	179	199
$(O)_2$ dry (%)	9.6	9.4	10.4	9.8	9.6	10.9	10.4
CO (ppm)*	22	0	0	0	0	0	0
HC (ppm)*	10	3	4	0	0	2	4
SO_x (ppm)*	———	———	———	———	———	———	———
SO_2 (ppm)*	———	———	———	———	———	———	———
Total Part. (lb/MBtu)	———	———	———	———	———	———	———
Solid Part. (lb/MBtu)	———	———	———	———	———	———	———
Boiler Efficiency (%)	———	———	———	83	———	85	84
Smoke Spot No.	———	———	———	———	———	———	———
Opacity (%)	———	———	———	———	———	———	———
Final Stm Pres. (psig)	312	312	312	302	305	311	312
Final Stm Temp. (°F)	554	554	554	554	554	554	554
Combus. Air Temp. (°F)	374	374	374	410	401	374	392
Stack Temp. (°F)	287	287	282	307	284	278	293
Fuel Flow (MSCFH)	190	190	192	327	286	199	292
Fuel Temp. (°F)	Amb.						▶
Fuel Pres. (psig)	4.7	5.0	4.8	6.0	4.1	4.8	4.9
Furnace Pres. (in. H_2O)	4.7	4.0	4.8	4.0	3.8	3.1	3.0
Register (% open)	70	70	70	70	70	70	70

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 9

Unit VA1

Fuel #6// Gas

Test No.	80-15	80-16	80-17	80-18	80-19	80-20	80-21
Test Type	Comb Air	M Air	M Air	Mid Air	Mid Air	Comb Air	M Air
Test Load (10^3 lb/hr)	250	250	255	260	254	260	250
Excess O_2 (%)	2.3	4.1	5.4	8.0	2.8	2.8	4.1
NO_x (ppm)*	199	218	185	191	212	217	222
NO (ppm)*	204	218	179	191	211	217	218
$(?)_2$ dry (%)	10.8	9.8	9.0	10.2	10.4	10.9	9.6
CO (ppm)*	36	0	0	0	0	19	18
HC (ppm)*	1	0	0	0	3	1	2
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	84						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	312	312	312	312	312	312	312
Final Stm Temp. (°F)	554	559	559	559	559	559	559
Combus. Air Temp. (°F)	59	101	101	102	102	101	59
Stack Temp. (°F)	293	293	293	289	289	289	279
Fuel Flow (Mscfh)	284	284	288	298	292	299	278
Fuel Temp. (°F)	Amb						Amb
Fuel Pres. (psig)	11.8	5.0	9.9	5.0	9.8	5.0	9.8
Furnace Pres. (in. H_2O)	.7	.7	.9	.7	.7	.9	.9
Register (% open)	70	70	70	70	70	70	70

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
$(x)_2$ dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (/Hr or F/H)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 9

Unit 1/4 : 1

Fuel Bit/ Oil

Test No.	80-09						
Test Type	46(in) Air						
Test Load (10^3 lb/hr)	179						
Excess O_2 (%)	3.1						
NO_x (ppm)*	183						
NO (ppm)*	175						
$(S)_2$ dry (%)	0.06						
(S) (ppm)*	0						
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part.(lb/MBtu)							
Solid Part.(lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres.(psig)	3674						
Final Stm Temp.(°F)	535						
Combus. Air Temp.(°F)	383						
Stack Temp.(°F)	268						
Fuel Flow (Mscfh)	216						
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	5.0						
Furnace Pres.(in.H_2O)	+.8						
Register (% open)	85.0						

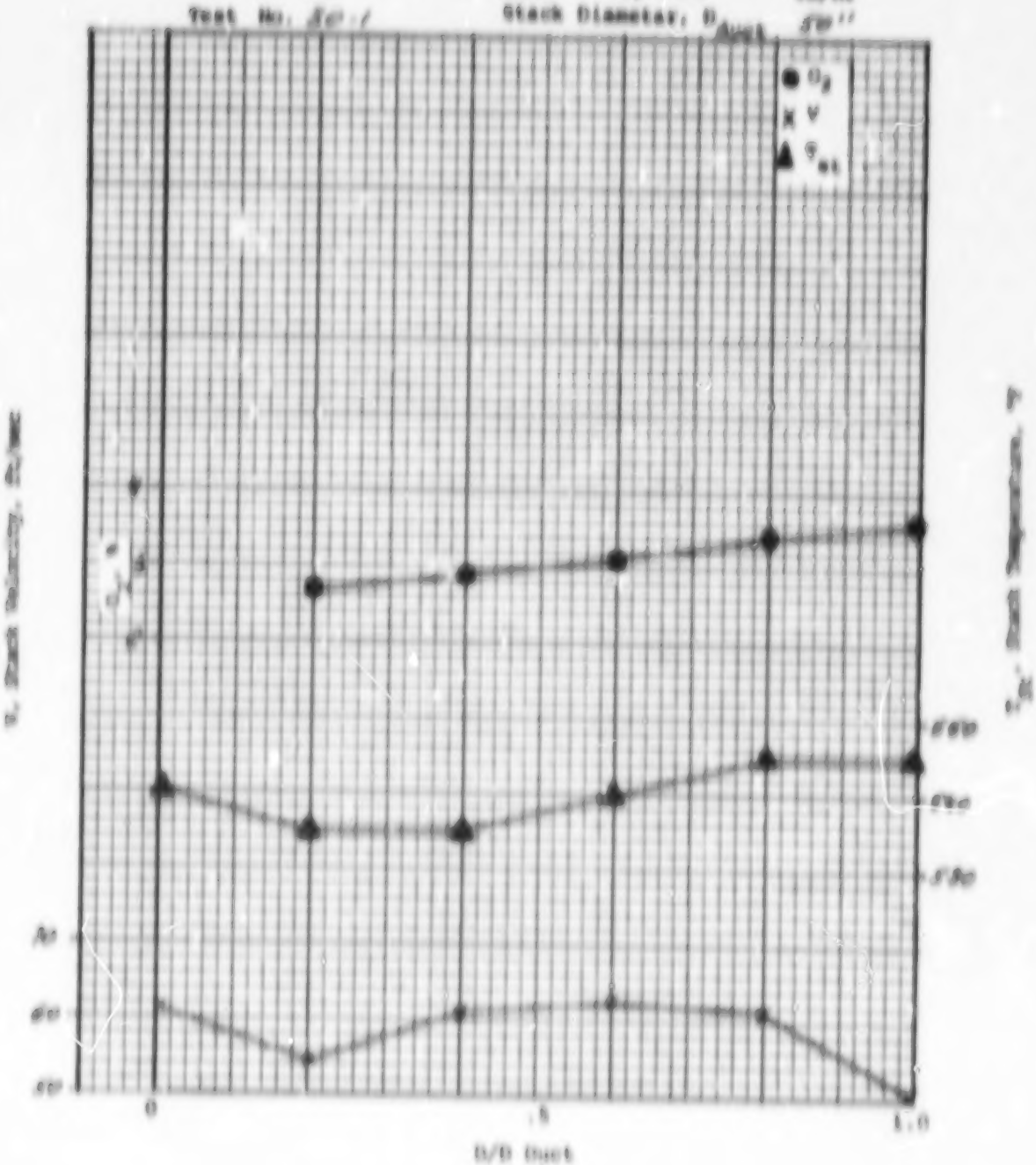
*at 3% O_2 dry

Radiation Smoke No.

STACK TRAVERSE DATA

Location No. 9
Unit No. 1/4 1
Test No. 80 1

Fuel #6// Gas
Load 154,000 lb/hr
Stack Diameter, D Avg. 50"



Location 9
Unit VA-1
Test 46, 50

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0	.0	0	.1	00.0	10.0	1100
0	.0	0	.1	00.0	10.0	1100
10	.0	0	.1	00.0	10.0	1100
10	.0	0	.1	00.0	10.0	1100
20	0	.0	0.0	70.0	00.0	1100
30	0	.0	0.0	70.0	00.0	1100
04	0	.0	0.0	70.0	00.0	1100
05	.0	0	.1	00.0	10.0	1100
06	0	.0	0.0	70.0	00.0	1100
07	.0	0	.1	00.0	10.0	1100
08	.0	0	.1	00.0	10.0	1100
09	.0	.0	0.0	00.0	0.0	000
10	.0	0	0.0	00.0	0	000
01	.0	0	.1	00.0	10.0	1100
07	.0	0	0.0	00.0	0	000
08	.0	.0	0.0	00.0	0.0	000
09	.0	0	0.0	00.0	0.0	000
50	.0	0	.1	00.0	10.0	1100
60	.0	0	.1	00.0	10.0	1100
07	.0	0	.1	00.0	10.0	1100
09	.0	0	.1	00.0	10.0	1100
70	0.0	0	0.0	00.0	00.0	1000
77	0.0	0	0.0	00.0	00.0	1000
00	0	.0	0.0	70.0	00.0	1100

INDUSTRIAL BOILER DATA

Location No. 40 Test No. 19 Unit No. 4

Unit Description Foster Wheeler D-Type Boiler

Installation Date	1960
Steam Output (10^3 lb/hr)	60
Design Pressur (psig)	300
Final Steam Temp (°F)	400
Furnace Type	Watertube
Furnace Size L-W-H (ft)	20 · 6 · 11
Furnace Area (ft^2)	812
Furnace Volume (ft^3)	1140
Burner Description	2 Foster Wheeler Ring Burners
Horiz. Burner Spacing (ft)	6
Vert. Burner Spacing (ft)	2' 9"
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 400

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location /D

Unit 4

Fuel Coal/ Gas

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
$(X)_2$ dry (%)							
(X) (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (scfm/#/)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

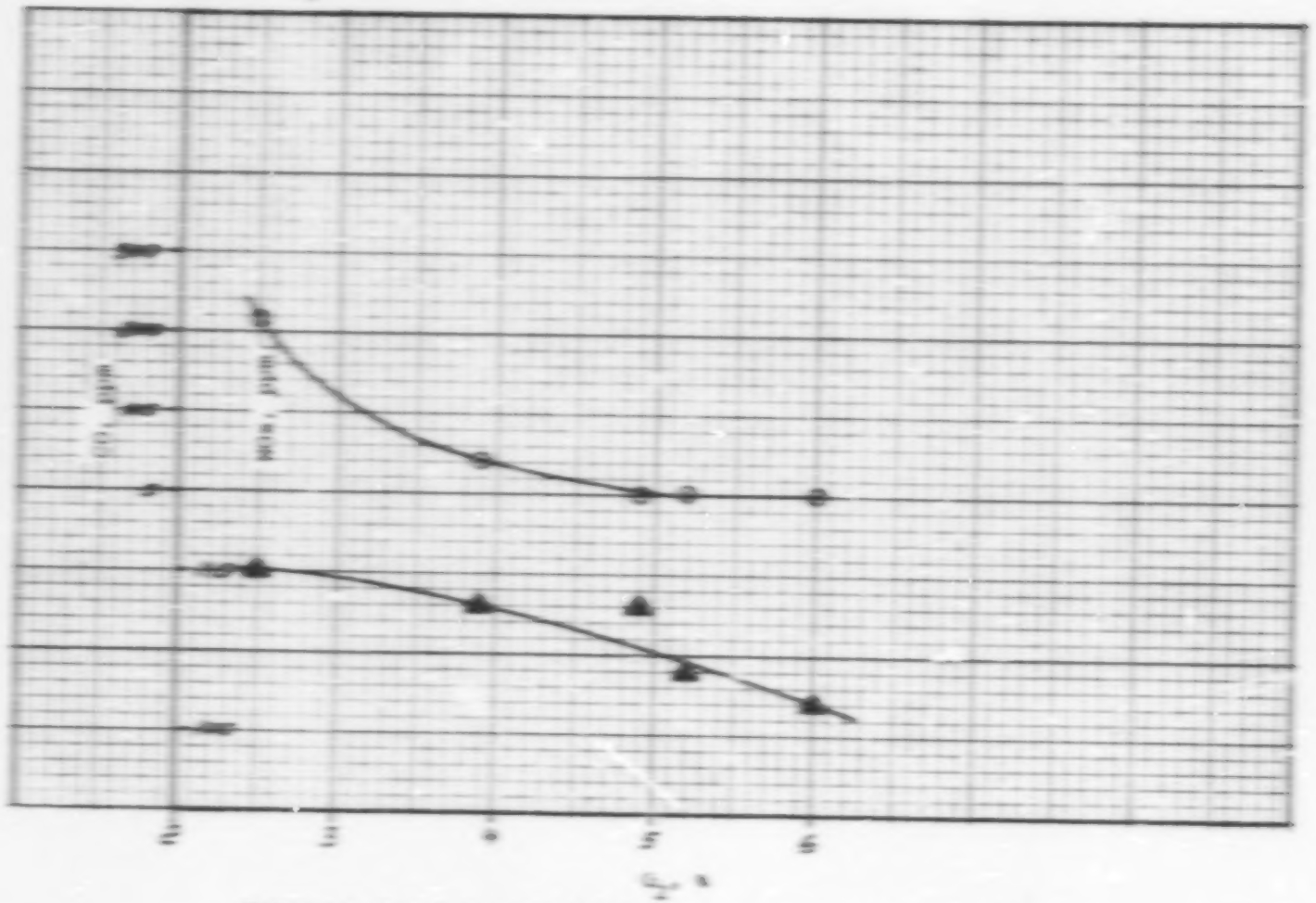
Location [illegible]

Unit 4

Fuel Natural Gas

Test No.	14:00	14:00					
Test Type	Normal Air	Over Fired					
Test Load (10^3 lb/hr)	300.5	280.5					
Excess O_2 (%)	2.9	2.7					
NO_x (ppm)*	90	87					
NO (ppm)*	85	83					
$(O_2)_{dry}$ (%)	7.0	6.8					
CO (ppm)*	0	0					
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		77					
Smoke Spot No.							
Opacity (%)							
Final Stm Press. (psig)	179	177					
Final Stm Temp. (°F)	580	580					
Combus. Air Temp. (°F)	Amb	Amb					
Stack Temp. (°F)	420	390					
Fuel Flow (Mscfh)	33.6	30.9					
Fuel Temp. (°F)	Amb	Amb					
Fuel Press. (psig)	2.4	2.4					
Furnace Press. ($in.H_2O$)	.15	.1					
Register (% open)	80	80					

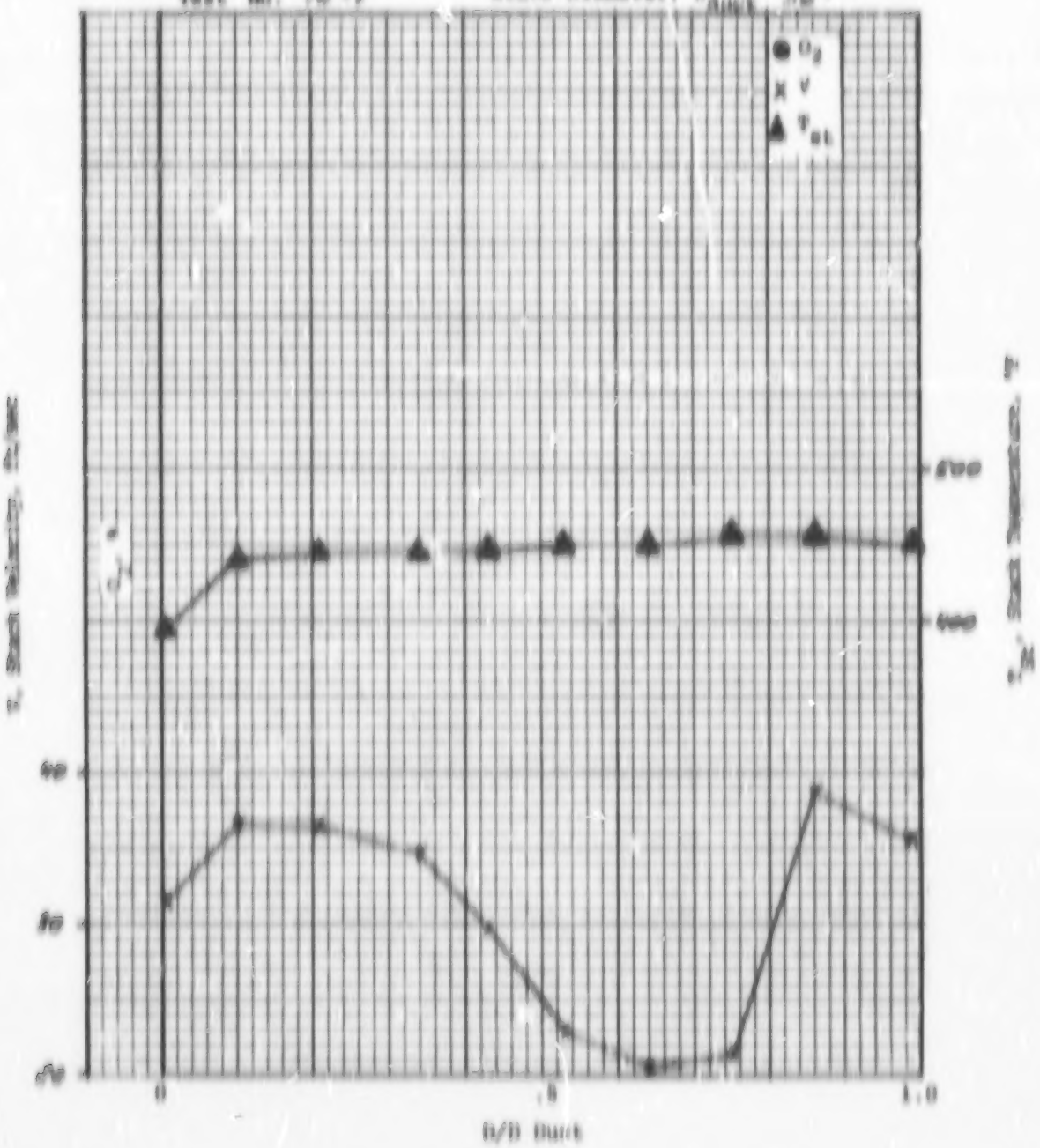
*at 3% O_2 dry



Emissions for Industrial Boilers as a Function of Excess Oxygen

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]
Unit No. [illegible] Load [illegible] lb/hr
Test No. [illegible] Stack Diameter, D_{duct} [illegible] ft



Locations for
Coal 4
Test No. 14

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	.9	0	.1	85.0	13.0	1100
8	.9	0	.1	85.0	13.0	1100
10	.9	0	.1	85.0	13.0	1100
13	.9	0	.1	85.0	13.0	1100
14	0	.5	6.6	74.0	20.0	1120
15	0	.5	6.6	74.0	20.0	1120
24	0	.5	6.6	74.0	20.0	1120
25	.9	0	.1	85.0	13.0	1100
26	0	.5	6.6	74.0	20.0	1120
27	.9	0	.1	85.0	13.0	1100
28	.9	0	.1	85.0	13.0	1100
29	.6	.6	6.3	88.9	3.6	984
40	.0	0	3.9	93.6	0	966
41	.9	0	.1	85.0	13.0	1100
47	.0	0	3.9	93.6	0	966
48	.6	.6	6.3	83.9	3.6	984
49	.6	0	6.4	84.1	6.7	987
56	.9	0	.1	85.0	13.0	1100
65	.9	0	.1	85.0	13.0	1100
67	.9	0	.1	85.0	13.0	1100
69	.9	0	.1	85.0	13.0	1100
76	1.0	0	1.3	88.6	89.7	1040
77	0.0	0	1.3	88.6	89.7	1040
80	0	.5	6.6	74.0	20.0	1120

INDUSTRIAL BOILER DESIGN DATA

Location No. 10 Test No. 80 Unit No. 5

Unit Description Union Iron Works Boiler Type A Serial No 23078

Installation Date	1968
Steam Output (10^3 lb/hr)	110
Design Pressure (psig)	600
Final Steam Temp (°F)	900
Furnace Type	Watertube
Furnace Size L-W-H (ft)	25 - 7 - 9
Furnace Area (ft^2)	98 ?
Furnace Volume (ft^3)	1650
Burner Description	1 Coen Fire Burner Model DAB 30 SV with double Register.
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	500

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_R (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]							
NO_R (ppm)[a]							
NO_2 (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]						[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (MSCFH)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]						[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
Register (% open)	[illegible]			[illegible]			

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (Nat'l)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

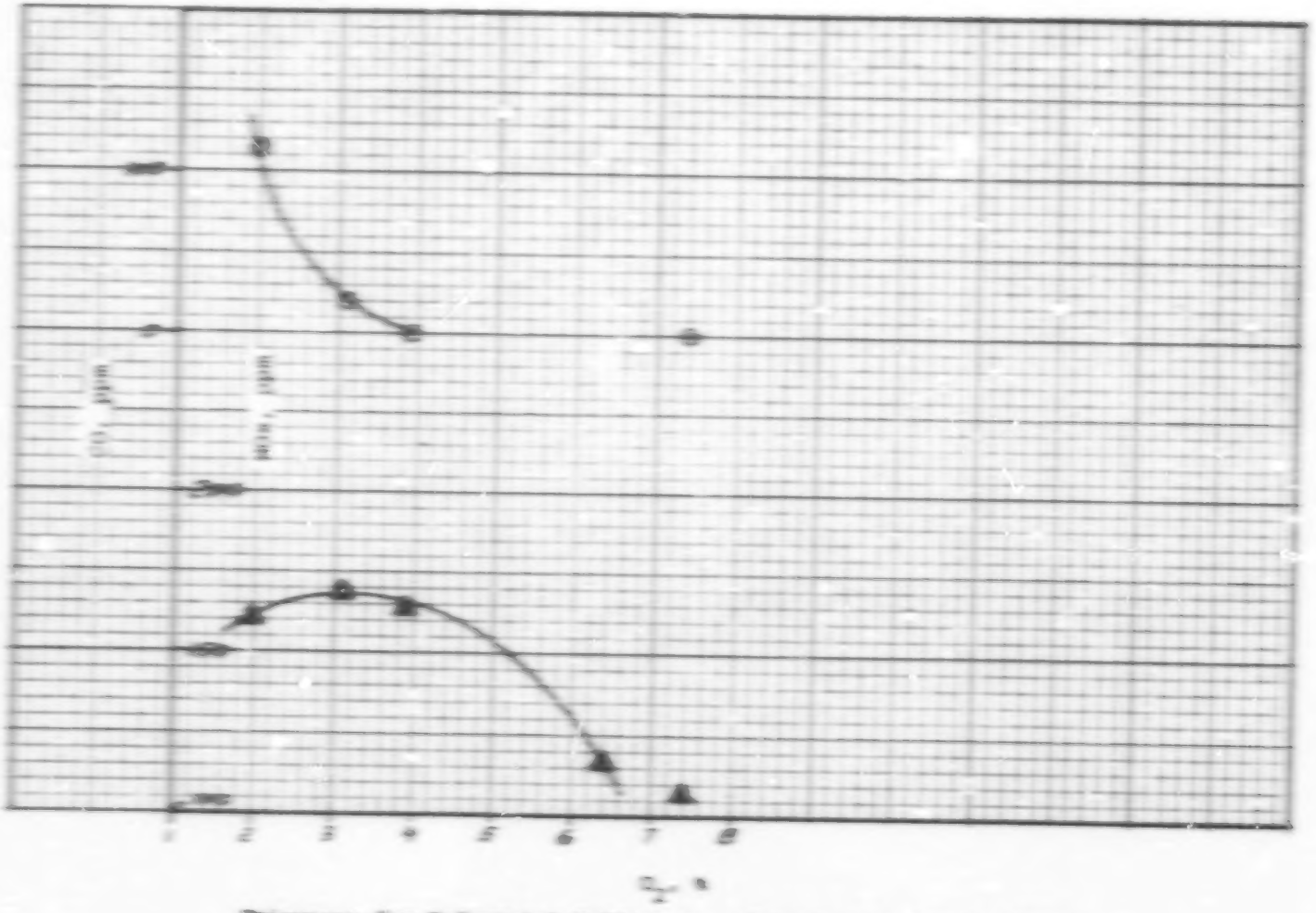
Location KP

Unit 5

Fuel Appl Coal

Test No.	80-15	80-16	80-17	80-18	80-19	80-20	
Test Type	Low Air	Low Air	Low Air	Low Air	Low Air	Ambient Air	
Test Load (10^3 lb/hr)	85	86	88	90	89	94.5	
Excess O_2 (%)	5.4	6.9	3.9	3.1	2.0	6.7	
CO (ppm)*	107	116	108	164	101	74	
NO (ppm)*	148	111	155	156	154	71	
O_2 dry (%)	8.6	8.8	10.1	10.4	11.0	8.6	
SO (ppm)*	0	0	0	80	114	0	
HC (ppm)*							
NO_x (ppm)*							
NO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)					78		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1800	1800	1770	1825	1800	1790	
Final Stm Temp. (°F)	1050	1050	1050	1050	1050	1050	
Combus. Air Temp. (°F)	Ambient					"	
Stack Temp. (°F)	340	320	290	280	270	295	
Fuel Flow	119.6	119.6	119.6	119.6	119.6	119.6	
Fuel Temp. (°F)	Ambient					"	
Fuel Pres. (psig)	10	10	8.5	8.5	8.0	8.0	
Furnace Pres. (in H_2O)	0.2	0.2	0.5	0.5	0.5	0.2	
Register (% open)	60-80	55-80	50-80	60-80	60-80	60-80	

*at 10% O_2 dry



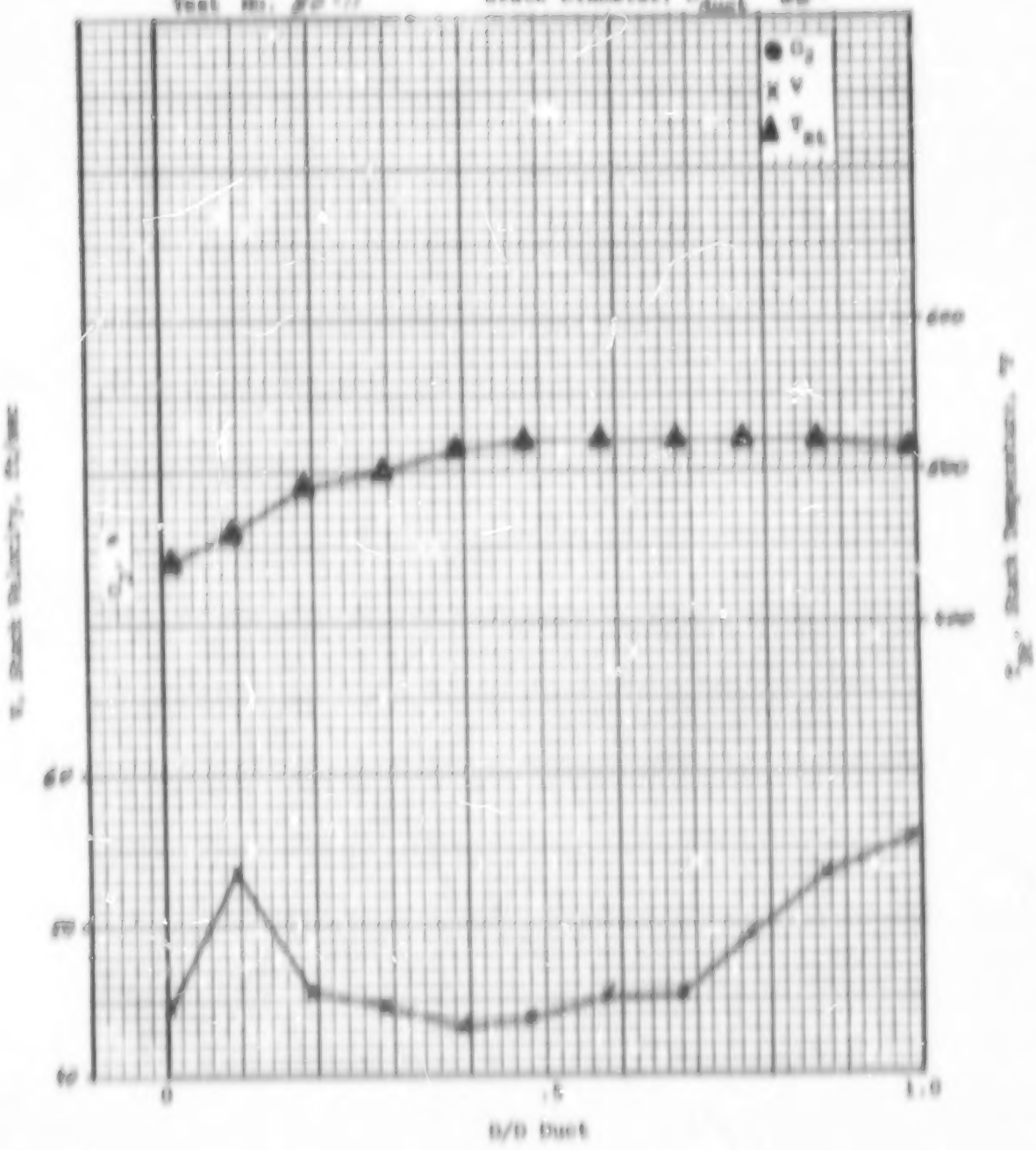
Emissions for Industrial Boilers as a Function of Excess Oxygen

Reduction for Industrial Boilers as a Function of Excess Oxygen

STACK TRAVERSE DATA

Location No. 5
Unit No. 5
Test No. 80-11

Fuel Coal/Oil
Load 85,000 lb/hr
Stack Diameter, D_{duct} 60"



Locations 10
Unit 5
Test No. 80

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	95.0	10.0	1100
5	.0	0	.1	95.0	10.0	1100
10	.0	0	.1	95.0	10.0	1100
11	.0	0	.1	95.0	10.0	1100
14	0	.0	0.1	74.0	20.0	1109
15	0	.0	0.1	74.0	20.0	1109
16	0	.0	0.1	74.0	20.0	1109
03	.0	0	.1	95.0	10.0	1100
02	0	.0	0.1	74.0	20.0	1109
07	.0	0	.1	95.0	10.0	1100
08	.0	0	.1	95.0	10.0	1100
09	.0	.0	0.1	90.0	0.0	904
00	.0	0	0.0	95.0	0	904
01	.0	0	.1	95.0	10.0	1100
07	.0	0	0.0	95.0	0	904
05	.0	.0	0.1	90.0	0.0	904
20	.0	0	0.0	94.1	0.7	907
08	.0	0	.1	95.0	10.0	1100
00	.0	0	.1	95.0	10.0	1100
07	.0	0	.1	95.0	10.0	1100
09	.0	0	.1	95.0	10.0	1100
10	0.0	0	0.1	89.0	00.7	1060
11	0.0	0	0.1	89.0	00.7	1060
00	0	.0	0.0	74.0	20.0	1109

INDUSTRIAL BOILER DESIGN DATA

Location No. 11 Test No. 18 Unit No. 1

Unit Description Riley Furnace, Serial No. 5307

Installation Date	1958
Steam Output (10^3 lb/hr)	135
Design Pressure (psig)	500
Final Steam Temp (°F)	470
Furnace Type	Watertube
Furnace Size L-W-H (ft)	17 - 11 - 23
Furnace Area (ft^2)	2122
Furnace Volume (ft^3)	6720
Burner Description	3 Riley spreader stokers
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~450

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location //

Unit /

Fuel coal

Test No.	10-1	10-2	10-3	10-4	10-5	10-6	10-7
Test Type	40% Excess Air	40% Excess Air	Base	40% Excess Air	10% Air	Lower Air	Lower Air
Test Load (10^3 lb/hr)	85	95	100	103	100	44	107
Excess O_2 (%)	7.0	8.2	7.0	5.5	6.0	4.9	5.8
NO_x (ppm)*	390	387	378	379	367	338	373
NO (ppm)*	383	378	366	371	367	326	373
$(O)_2$ dry (%)	11.4	11.4	12.0	13.6	12.9	13.5	13.2
CO (ppm)*	28	27	58	82	72	167	94
HC (ppm)*	29	26	28	———	11	13	7
SO_x (ppm)*	———	———	———	1854	———	———	———
SO_2 (ppm)*	———	———	———	1837	———	———	———
Total Part. (lb/MBtu)	———	———	———	———	———	———	———
Solid Part. (lb/MBtu)	———	———	———	———	———	———	———
Boiler Efficiency (%)	———	———	82	———	———	80	———
Smoke Spot No.	———	———	———	———	———	———	———
Opacity (%)	———	———	———	———	———	———	———
Final Stm Pres. (psig)	950	950	950	950	950	950	950
Final Stm Temp. (°F)	900	900	900	900	900	900	900
Combus. Air Temp. (°F)	Amb.	———	———	———	———	———	———
Stack Temp. (°F)	428	437	429	425	426	401	401
Fuel Flow	———	———	———	———	———	———	———
Fuel Temp. (°F)	Amb.	———	———	———	———	———	———
Fuel Pres. (psig)	———	———	———	———	———	———	———
Furnace Pres. (in. H_2O)	-0.17	-1.05	-0.8	-0.18	-0.18	-0.03	-0.10
Register (% open)	———	———	———	———	———	———	———

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL SYSTEM DATA

Location [illegible]

Unit 1

Fuel Coal

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible] Air	[illegible] Air	[illegible] Air	[illegible]	[illegible] Air	[illegible]	[illegible] Air
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)				[illegible]			
Solid Part. (lb/MBtu)				[illegible]			
Boiler Efficiency (%)						[illegible]	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	Ambient						
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow							
Fuel Temp. (°F)	Ambient						
Fuel Pres. (psig)							
Furnace Pres. (in.H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location //

Unit 1

Fuel Coal

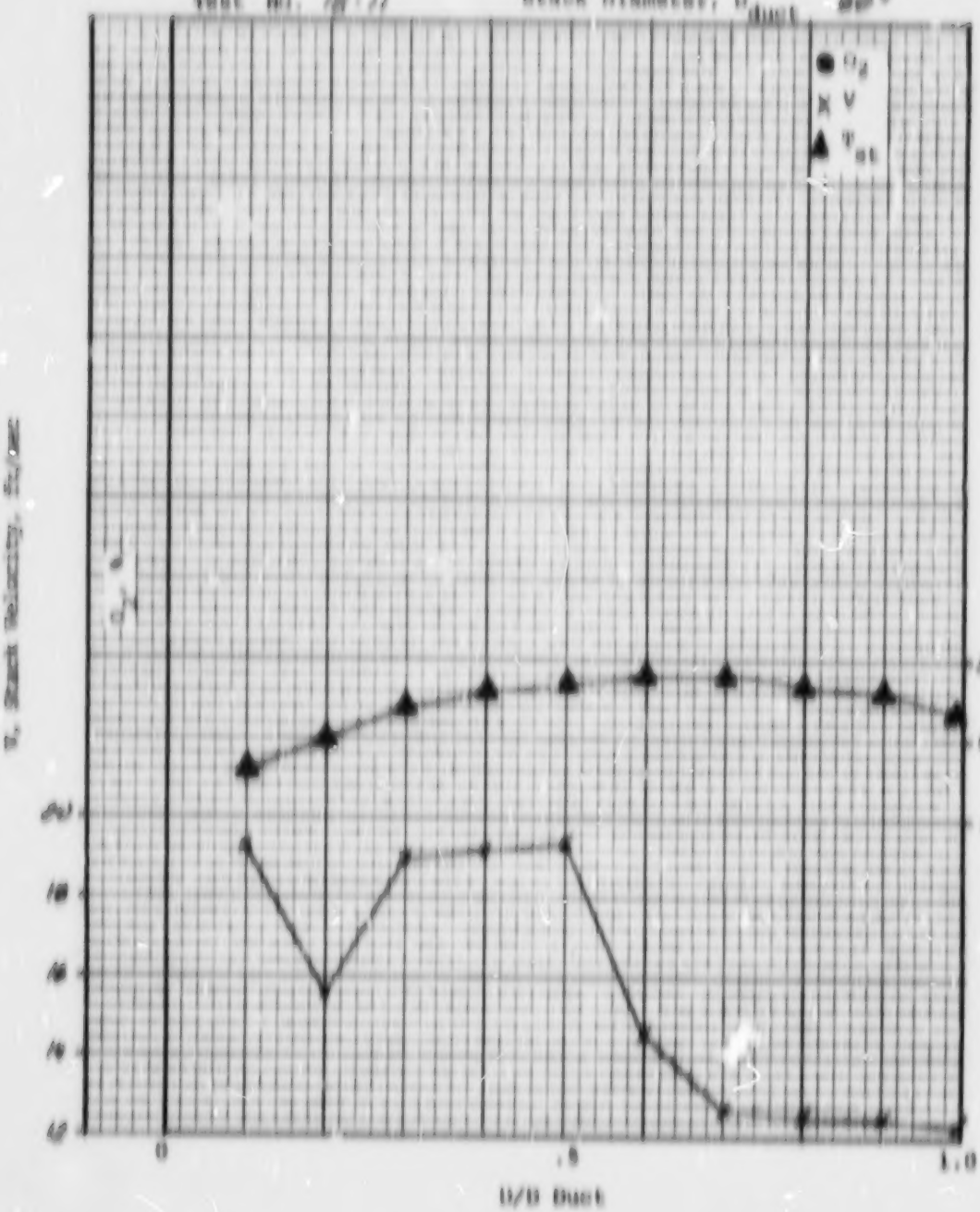
Test No.	10-13	10-14	10-15	10-16	10-17	10-20	10-21
Test Type	Low Air	Low Air	Low Air	Low Air	Normal Air	Hi Load	Normal Air
Test Load (10^3 lb/hr)	75	75	75	75	121	130	110
Excess O_2 (%)	6.5	8.1	8.4	6.5	7.4	5.2	6.6
NO_x (ppm)*	369	374	404	337	429	423	385
NO (ppm)*	349	358	390	329	409	410	379
$(S)_2$ dry (%)	13.0	11.6	11.0	12.4	12.2	12.2	12.7
CO (ppm)*	0	0	0	0	53	52	50
HC (ppm)*	0	0	0	0	———	———	———
SO_x (ppm)*	———	———	———	———	———	———	———
SO_2 (ppm)*	———	———	———	———	———	———	———
Total Part. (lb/MBtu)	———	———	———	———	———	———	———
Solid Part. (lb/MBtu)	———	———	———	———	———	———	———
Boiler Efficiency (%)	———	———	———	———	———	80	———
Smoke Spot No.	———	———	———	———	———	———	———
Opacity (%)	———	———	———	———	———	———	———
Final Stm Pres. (psig)	455	455	455	455	457	450	450
Final Stm Temp. (°F)	900	900	900	900	900	900	900
Combus. Air Temp. (°F)	Amb.						"
Stack Temp. (°F)	400	407	415	395	488	494	457
Fuel Flow	———	———	———	———	———	———	———
Fuel Temp. (°F)	Amb.						"
Fuel Pres. (psig)	———	———	———	———	———	———	———
Furnace Pres. (in. H_2O)	-0.17	-0.15	-0.16	-0.16	-0.19	-0.17	-0.18
Register (% open)	———	———	———	———	———	———	———

*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. V
Unit No. 1
Test No. 1@:11

Fuel Coal
Load 110,000 lb/hr
Stack Diameter, D_{duct} @@'



Variations for Interfering Wings as a Function of Sweep Angle

Emissions for Industrial Boilers as a Function of Excess Oxygen

Reference Number 1

Unit No. 1

Unit No. 16

Unit 73,000 lb/hr

Fuel Coal

● Smoke X NO

□ CO ▲ SO_2

NO, ppm

CO, ppm

O_2, %

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 · 225-1565
CABLE: TRUELABS

CLIENT: EVR Equipment Corp.
17332 Irvine Blvd.
Tustin, Calif. 92680
Attn: Glenn Gato

DATE: May 23, 1974

RECEIVED: May 1, 1974

SAMPLE: 5 Coal Samples and - Fuel Oil Samples, as shown.

LABORATORY NO. 132116

P.O.: 1700-43

INVESTIGATION: Analysis and tests as requested

Location #1
Unit 1
Test 18

RESULTS

SAMPLE IDENTIFICATION:

1. Coal - Test 18-4,

The results of the coal analysis are as follows:

	No. 1
As Received:	
Moisture, %	5.96
Carbon, %	70.02
Hydrogen, %	5.34
Nitrogen, %	1.40
Sulfur, %	2.96
Ash, %	4.77
Oxygen, % (by difference)	9.57

(Continued)

Duplicate of
Unit 1
Test #8

	No. 1
Heat of Combustion:	
Gross, BTU/lb	13,690
Net, BTU/lb	12,190
Dry Basis:	
Carbon, %	74.66
Hydrogen, %	5.68
Nitrogen, %	1.69
Sulfur, %	3.13
Ash, %	5.07
Oxygen, % (by difference)	10.17
Heat of Combustion:	
Gross, BTU/lb	13,490
Net, BTU/lb	12,960

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Ignas Bandzaitis
Supervisor, Air Pollution Testing

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 / 225-1041
CABLE: TRUSLABS

CLIENT: EVR Engineering
17332 Irvine Blvd.
Tustin, CA 92680
Attn: Hans Buening

DATE: August 7, 1974

RECEIVED: August 1, 1974

SAMPLE: 4 Coals previously submitted for other analyses marked as shown

LABORATORY NO. 1052

P.O. No. 6000

INVESTIGATION: Determination of density

Location #4
Unit 1
Test 18

RESULTS

	Density (g/ml.)
Test No. 18-4	1.478

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Alvin E. May

Alvin E. May
Director of Laboratories

INDUSTRIAL BOILER DESIGN DATA

Location No. 42 Test No. 26, 28 Unit No. 34

Unit Description CE Corner Fired Boiler
Serial No. 9963

Installation Date	1966
Steam Output (10^3 lb/hr)	525
Design Pressure (psig)	690
Final Steam Temp (°F)	725
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	16 - 17 - 85
Furnace Area (ft^2)	4014
Furnace Volume (ft^3)	13400
Burner Description	4 CE Pulverized Coal Burners
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	4
Test Fuel	Coal & Natural Gas
Fuel Temp at Burner (°F)	Ambient for Natl Gas, ~150 for Coal
Primary Air Temp (°F)	~660
Stack Temp (°F)	~360

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL MODE DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
CO_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (MscFH)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 12

Unit 04

Fuel Natl Gas

Test No.	12-01	12-02	12-03	12-04	12-05	12-06	12-07
Test Type	Comb Air	Comb Air	XS Air	Comb Air	Comb Air	Staging Air	XS Air
Test Load (10^3 lb/hr)	185	185	185	185	185	185	185
Excess O_2 (%)	4.9	5.2	7.9	5.4	5.3	6.2	6.7
NO_x (ppm)*	139	190	265	173	168	169	163
NO (ppm)*	134	175	236	172	167	164	160
CO_2 dry (%)	10.0	9.4	8.2	9.4	9.5	8.8	8.6
CO (ppm)*	564	368					
HC (ppm)*	9	8	9	12	12	7	14
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	88						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	905	905	905	870	870	870	870
Final Stm Temp. (°F)	715	715	715	715	700	710	710
Combus. Air Temp. (°F)	690	690	690			690	695
Stack Temp. (°F)	345	342	340	345	345	345	340
Fuel Flow (MSCFH)	170	170	170	170	170	175	175
Fuel Temp. (°F)	Amb						
Fuel Pres. (psig)	10	10	10				
Furnace Pres. (in. H_2O)	-0.6	-0.8	-0.6	-0.7	-0.8	-0.85	-0.8
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location AP

Unit 6PP

Fuel Anvil Gas

Test No.	25-15	25-16	25-17				
Test Type	Air Htrgs	Air Htrgs	Air Htrgs				
Test Load (10^3 lb/hr)	180	180	180				
Excess O_2 (%)	6.6	6.1	6.0				
NO_x (ppm)*	182	157	145				
NO (ppm)*	159	154	148				
CO_2 dry (%)	8.6	8.8	9.1				
CO (ppm)*							
HC (ppm)*	16	18	13				
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		84					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1500	1510	1500				
Final Stm Temp. (°F)	950	1000	1005				
Combus. Air Temp. (°F)	650	645	645				
Stack Temp. (°F)	354	350	350				
Fuel Flow (MscFH)	175	175	175				
Fuel Temp. (°F)	Amb.		→				
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.4	-0.8	-0.2				
Register (% open)							

*at 3% O_2 dry

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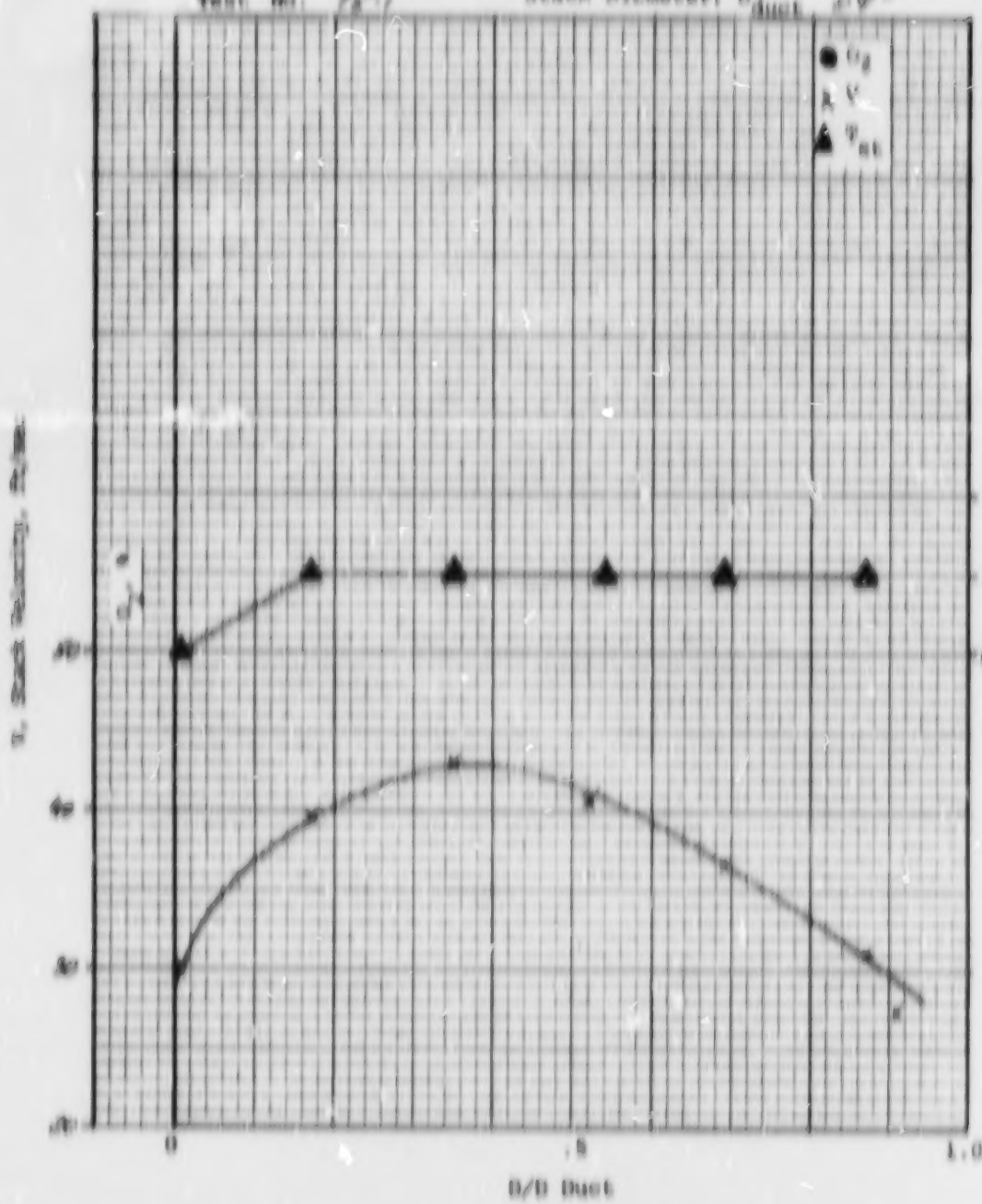
STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. [illegible] Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D [illegible] Duct



TENNESSEE GAS PIPELINE COMPANY
GAS SAMPLE ANALYSIS

Location 40
Sheet 24
Feet 45

PRODUCER: ALABAMA-TENN. NAT. GAS CO.
LOCATION: CORINTH MISSISSIPPI SALES
STATION NO.(COLS 1-5) 0- 58- 1 COMPOSITE CODE(COL 7)
ANALYSIS DATE(COL 61-66) 9 6 73

ANALYSIS	KEYPUNCH COLUMN	MOL FRACTION	GPM 14.696PSIA AT 60 F	SP.GR. AT 60 F (AIR=1)
CARBON DIOXIDE	8-11	0.0098		0.0141
NITROGEN	12-15	0.0083		0.0088
OXYGEN	16-19	0.0000		0.0000
METHANE	20-23	0.9581	16.273	0.5317
ETHANE	24-27	0.0248	0.688	0.0853
PROPANE	28-31	0.0039	0.109	0.0060
ISO-BUTANE	32-35	0.0011	0.037	0.0023
N-BUTANE	36-39	0.0007	0.023	0.0014
ISO-PENTANE	40-43	0.0003	0.010	0.0006
N-PENTANE	44-47	0.0002	0.008	0.0005
HEXANES PLUS	48-51	0.0000	0.000	0.0000
TOTAL		1.0000	17.081	0.5843

COMPOSITE CODES
1=GREEN BRANCH LINE 4=MAIN VALLEY LINE 7=DELTA LINE(V-516 TO V-8601)
2=HIGH VALLEY LINE 5=AK LINE 8=MAIN LINE(ST.1 TO ST.87)
3=BRANCH(1-8) 6=KP LINE 9=TOTAL SYSTEM

FIELD DATA
PRES. 717.0PSI TEMP 88.0F SP.GR. 0.5860 BTU 0.
HROU.P. 0. F AT 0. PSI HYD.D.P. 0. F AT 0. PSI
TAKEN BY WEDGEWORTH DATE 8 28 73 DOHS NO

LAB DATA
SP.GR.(DAL.) 0.5530 SP.GR.(CALC.) 0.5843 *BTU(DRY) 1034.
ANALYSIS NO 68716 DEV.TEST NO. 6- 0 *BTU(WET) 1016.

ANALYSIS BY LEWIS

REMARKS: ABOVE ZEROS INDICATE DATA NOT AVAILABLE
*BTU / CU FT AT 14.73 PSIA AT 60F
QUARTERLY ANALYSIS**
AR

U340

BOILER EMISSION MEASUREMENTS AND CONTROL BOOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	Base	Low Air	Hi Air	Hi Air	[illegible] Air	[illegible] Air	Hi Load
Test Load (10^3 lb/hr)	181	188	180	180	175	202	238
Excess O_2 (%)	6.3	4.5	5.9	6.5	6.2	5.2	5.3
NO_x (ppm)*	383	364	414	450	367	403	448
NO (ppm)*	364	346	402	444	361	391	431
O_2 dry (%)	13.6	14.4	13.2	13.6	13.8	13.8	13.6
CO (ppm)*	0	0	0	0	----	----	----
HC (ppm)*	14	6	11	5	12	6	10
SO_x (ppm)*	[illegible]	----	----	----	----	----	----
SO_2 (ppm)*	[illegible]	----	----	----	----	----	----
Total Part. (lb/MBtu)	----	----	----	----	[illegible]	----	----
Solid Part. (lb/MBtu)	----	----	----	----	[illegible]	----	----
Boiler Efficiency (%)	86	86	----	----	----	----	85
Smoke Spot No.	----	----	----	----	----	----	----
Opacity (%)	----	----	----	----	----	----	----
Final Stm Pres. (psig)	505	505	505	505	505	505	505
Final Stm Temp. (°F)	730	730	730	730	730	730	730
Combus. Air Temp. (°F)	645	653	657	665	660	695	730
Stack Temp. (°F)	368	370	366	364	370	380	395
Fuel Flow (lb/hr)	[illegible]	----	----	----	----	----	----
Fuel Temp. (°F)	150	165	170	170	170	180	190
Fuel Pres. (psig)	----	----	----	----	----	----	----
Furnace Pres. (in. H_2O)	-0.3	-0.2	-0.4	-0.03	-0.04	-0.1	-0.1
Register (% open)	----	----	----	----	----	----	----

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible] Air	[illegible] Air	[illegible] Air	[illegible] Air Regr.	[illegible] Air Regr.	[illegible] Air Regr.	[illegible] Air Regr.
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combun. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a]at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL BOOK DATA

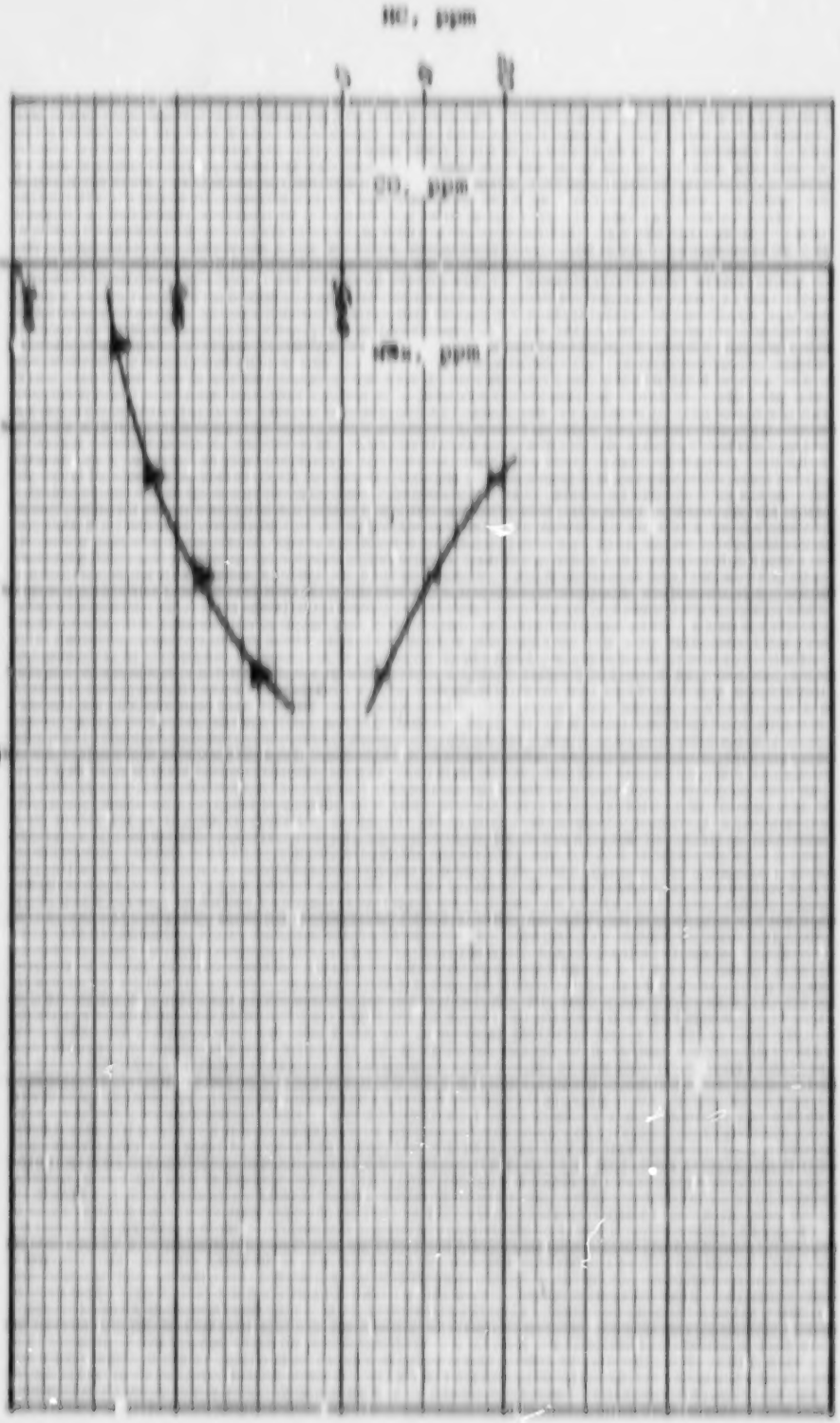
Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]						
Test Type	[illegible]						
Test Load (10^3 lb/hr)	[illegible]						
Excess O_2 (%)	[illegible]						
NO_x (ppm)*	[illegible]						
NO (ppm)*	[illegible]						
$(O)_2$ dry (%)	[illegible]						
CO (ppm)*	———						
HC (ppm)*	[illegible]						
SO_x (ppm)*	———						
SO_2 (ppm)*	———						
Total Part. (lb/MBtu)	———						
Solid Part. (lb/MBtu)	———						
Boiler Efficiency (%)	———						
Smoke Spot No.	———						
Opacity (%)	———						
Final Stm Pres. (psig)	[illegible]						
Final Stm Temp. (°F)	[illegible]						
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]						
Fuel Flow	———						
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)	———						
Furnace Pres. (in. H_2O)	[illegible]						
Register (% open)	———						

*at 3% O_2 dry

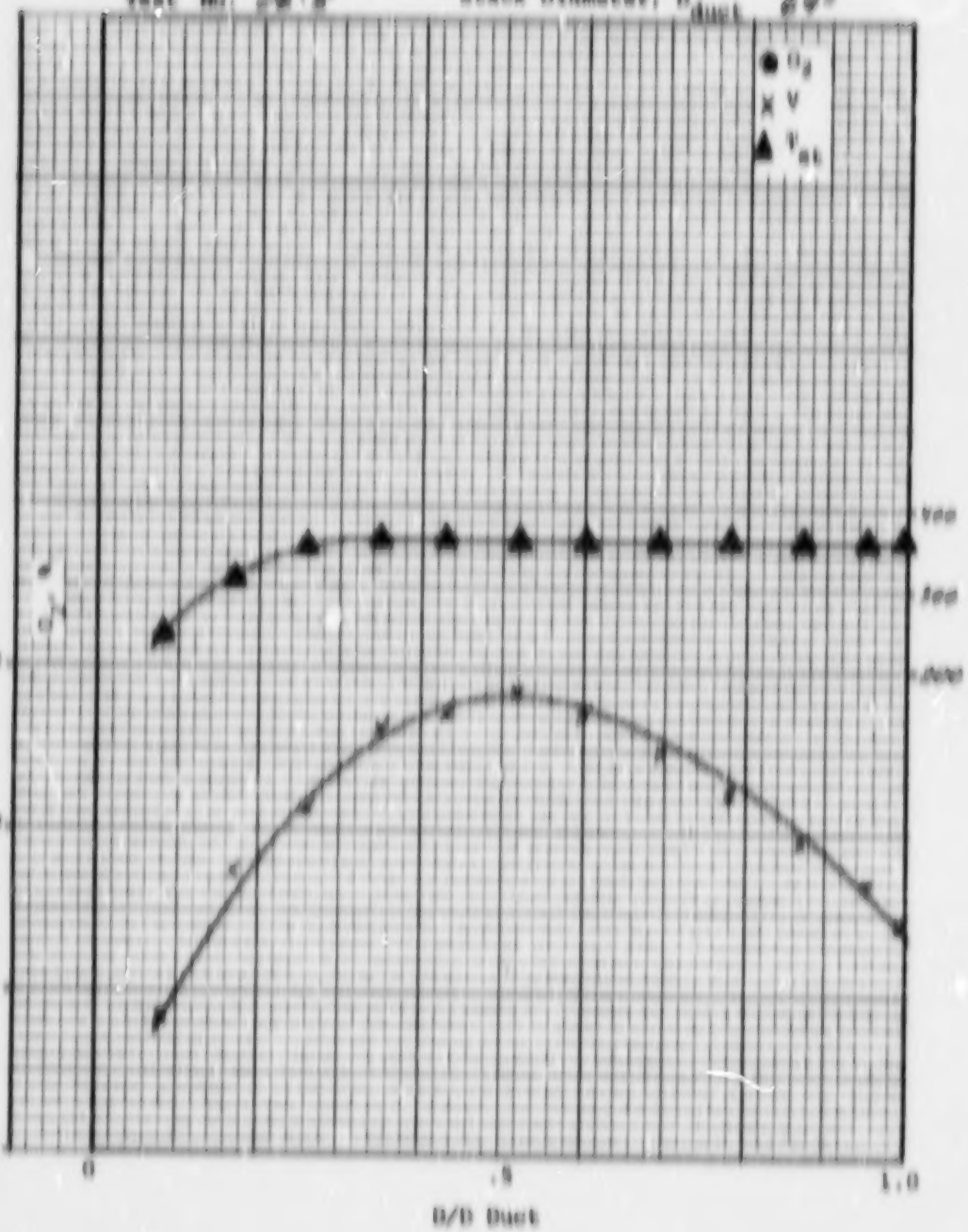

NO, ppm
CO, ppm
HCs, ppm

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. [illegible] Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D_{duct} [illegible]



REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

6161 N. FIGUEROA STREET
LOS ANGELES 90042
AREA CODE 213 | 256-16
CABLE: TRUELAB

CLIENT: KVB Equipment Corp.
17332 Irvine Blvd.
Tustin, Calif. 92680
Attn: Glenn Cato

DATE: May 23, 1974

RECEIVED: May 1, 1974

SAMPLE: 5 Coal Samples and 2 Fuel Oil Samples, as shown.

LABORATORY NO. 122116

P.O.: 1700-43

INVESTIGATION: Analysis and tests as requested

RESULTS

Location 12
Unit 24
Test 26
SAMPLE IDENTIFICATION:

No. 3, Coal - Part. Test #26-b; Boiler #24, 3-19-74

The results of the coal analysis are as follows:

	No. 3
As Received:	
Moisture, %	7.43
Carbon, %	65.44
Hydrogen, %	4.92
Nitrogen, %	1.40
Sulfur, %	4.20
Ash, %	9.36
Oxygen, % (by difference)	7.25

(Continued)

	No. 3
Heat of Combustion:	
Gross, BTU/lb	11,430
Net, BTU/lb	10,980
Dry Basis:	
Carbon, %	70.58
Hydrogen, %	5.31
Nitrogen, %	1.51
Sulfur, %	4.56
Ash, %	10.11
Oxygen, % (by difference)	7.85
Heat of Combustion:	
Gross, BTU/lb	12,350
Net, BTU/lb	11,860

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Tenas Bandziulis
Supervisor, Air Pollution Testing

INDUSTRIAL BOILER DESIGN DATA

Location No. [illegible] Test No. [illegible] Unit No. [illegible]

Unit Description: 62 Corner Fired Boiler
Type VU-60B

Installation Date	1968
Steam Output (10^3 lb/hr)	825
Design Pressure (psig)	870
Final Steam Temp (°F)	825
Furnace Type	Watertube
Furnace Size L-W-H (ft)	50 - 18 - 82
Furnace Area (ft^2)	5110
Furnace Volume (ft^3)	20,800
Burner Description	8 CE Pulverized Coal Burners 6 CE Gas Burners
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	2' for Gas Burner & 6' for Coal Burner
Test Fuel	Natural Gas & Coal
Fuel Temp at Burner (°F)	Amb. for Nat'l Gas, 170 for Coal
Primary Air Temp (°F)	600
Stack Temp (°F)	310

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
NO_x (ppm)[1]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
NO (ppm)[1]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
$(O)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
CO (ppm)[1]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	
HC (ppm)[1]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
SO_x (ppm)[1]							
SO_2 (ppm)[1]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		[illegible]					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Combus. Air Temp. (°F)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Flow							
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Register (% open)							

[1] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Coal

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow lb/hr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a] at 1% O_2 dry

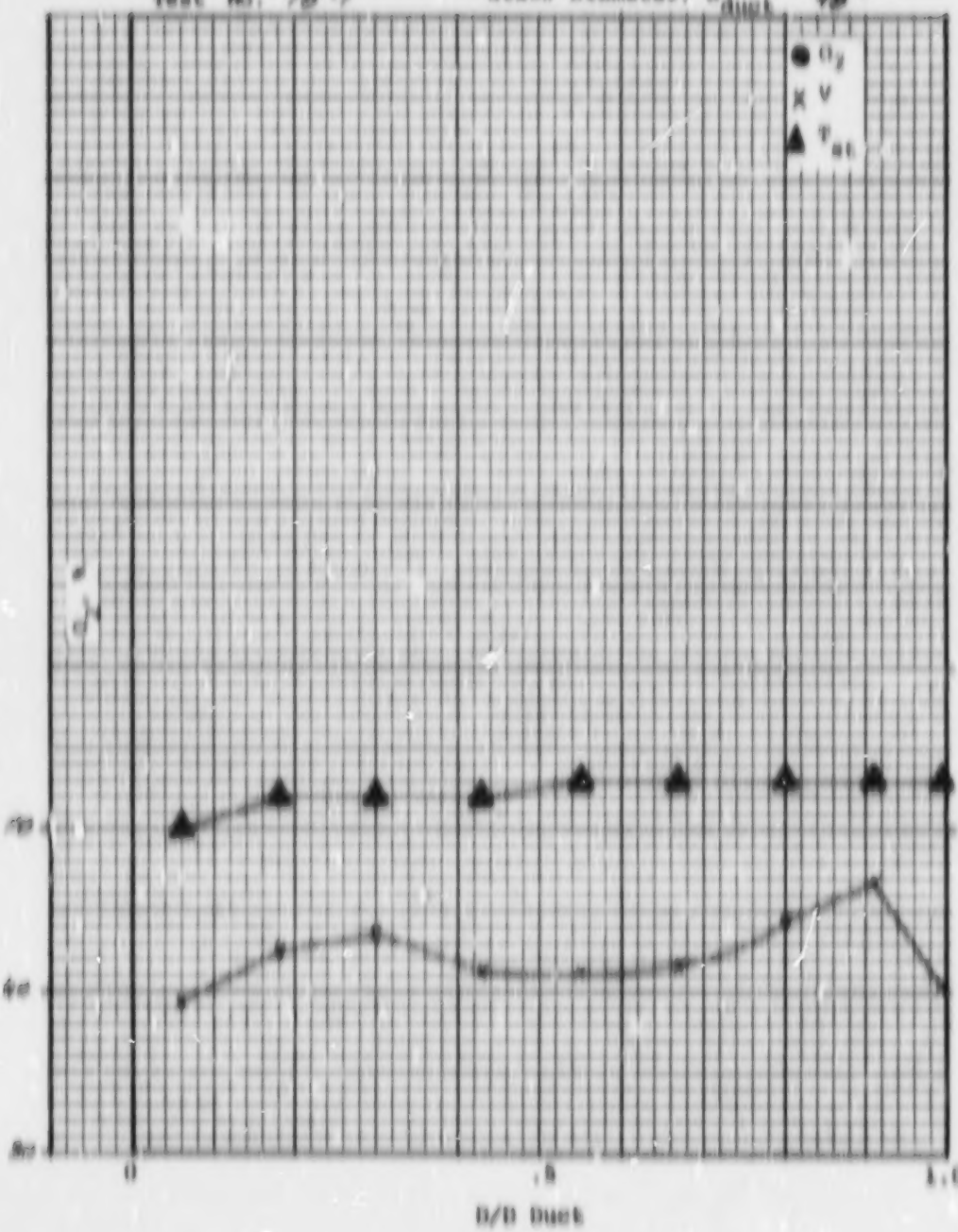
Bacharach Smoke No.
NO, ppm
CO, ppm
NO, ppm

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. [illegible] Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D_{duct} [illegible] ft



REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 · 225-1565
CABLE: TRUELABS

CLIENT: KVB Equipment Corp.
17332 Irvine Blvd.
Tustin, Calif. 92680
Attn: Glenn Cato

DATE: May 23, 1974

RECEIVED: May 1, 1974

LABORATORY NO. 122116

SAMPLE: 5 Coal Samples and 2 Fuel Oil Samples, as shown.

P.O.: 1700-43

INVESTIGATION: Analysis and tests as requested

Locations 12
Unit EW
Test 78

RESULTS

SAMPLE IDENTIFICATION:

1. Coal - 3-14-74

The results of the coal analysis are as follows:

	No. 1
As Received:	
Moisture, %	8.19
Carbon, %	62.28
Hydrogen, %	4.70
Nitrogen, %	1.34
Sulfur, %	0.74
Ash, %	11.58
Oxygen, % (by difference)	9.17

(Continued)

	No. 2
Heat of Combustion/	
Gross, BTU/lb	11,160
Net, BTU/lb	10,720
Dry Basis:	
Carbon, %	67.84
Hydrogen, %	5.12
Nitrogen, %	1.46
Sulfur, %	2.99
Ash, %	12.61
Oxygen, % (by difference)	9.98
Heat of Combustion:	
Gross, BTU/lb	12,160
Net, BTU/lb	11,680

Combustion 12
Unit 20
Test 28

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Agnes Bardauskis
Supervisor, Air Pollution Testing

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	PP-1	PP-2	PP-3	PP-4	PP-5	PP-6	PP-7
Test Type	Normal Air	Normal Air	Normal Air	Normal Air	Low excess	Normal Air	Normal Air
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	———	3.8	3.5	4.1	4.7	4.7	4.7
NO_x (ppm)*	———	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	———	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(O)_2$ dry (%)	———	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	———	0	0	0	0	0	0
HC (ppm)*	———	———	———	———	———	6	7
SO_x (ppm)*	———	———	———	———	———	———	———
SO_2 (ppm)*	———	———	———	———	———	———	———
Total Part. (lb/MBtu)	[illegible]	———	———	———	———	———	———
Solid Part. (lb/MBtu)	———	———	———	———	———	———	———
Boiler Efficiency (%)	———	———	———	———	85	———	———
Smoke Spot No.	———	———	———	———	———	———	———
Opacity (%)	———	———	———	———	———	———	———
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (Nat FM)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	Ambient						
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Registers (% open)	———	———	———	———	———	———	———

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 12

Unit 20

Fuel Natl Gas

Test No.	PP-8	PP-9	PP-10	PP-11	PP-12	PP-13	PP-14
Test Type	Normal Air	Normal Air	M. Load	Base	Low Air	Low Air	M. Air
Test Load (10^3 lb/hr)	280	280	200	280	280	280	280
Excess O_2 (%)	4.5	4.2	5.9	4.5	4.0	3.5	5.3
NO_x (ppm)*	270	291	342	327	300	287	336
NO (ppm)*	267	310	324	309	314	275	302
$(O)_2$ dry (%)	9.4	9.0	9.6	9.3	9.7	10	9.2
CO (ppm)*	0	0	0	0	0	0	0
HC (ppm)*	6	7	4	6	6	7	5
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			89	88		88	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	570	570	570	570	570	570	570
Final Stm Temp. (°F)	695	695	695	700	700	700	700
Combus. Air Temp. (°F)	660	665	680	693	690	690	695
Stack Temp. (°F)	350	366	378	350	350	350	340
Fuel Flow (MSCFH)	360	390	410	366	365	366	365
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	17	19	13	19	19	19	19
Furnace Pres. (in. H_2O)	-0.08	-0.06	-0.16	-0.4	-0.4	-0.6	-0.4
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 42

Unit #2

Fuel #6// Gas

Test No.	77-15	77-16	77-17				
Test Type	M Air	Normal Air	Normal Air				
Test Load (10^3 lb/hr)	285	260	285				
Excess O_2 (%)	6.2	4.5	5.8				
NO_x (ppm)*	388	347	345				
NO (ppm)*	344	339	319				
$(O)_2$ dry (%)	8.6	9.4	8.8				
CO (ppm)*	0	0	0				
HC (ppm)*	7	6	5				
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	5 PW	5 PW	5 PW				
Final Stm Temp. (°F)	700	695	690				
Combus. Air Temp. (°F)	695	695	695				
Stack Temp. (°F)	342	340	340				
Fuel Flow	285	260	285				
Fuel Temp. (°F)	Amb.		"				
Fuel Pres. (psig)	17	16	16				
Furnace Pres. (in. H_2O)	-0.9	-0.4	-0.9				
Register (% open)							

*at 3% O_2 dry

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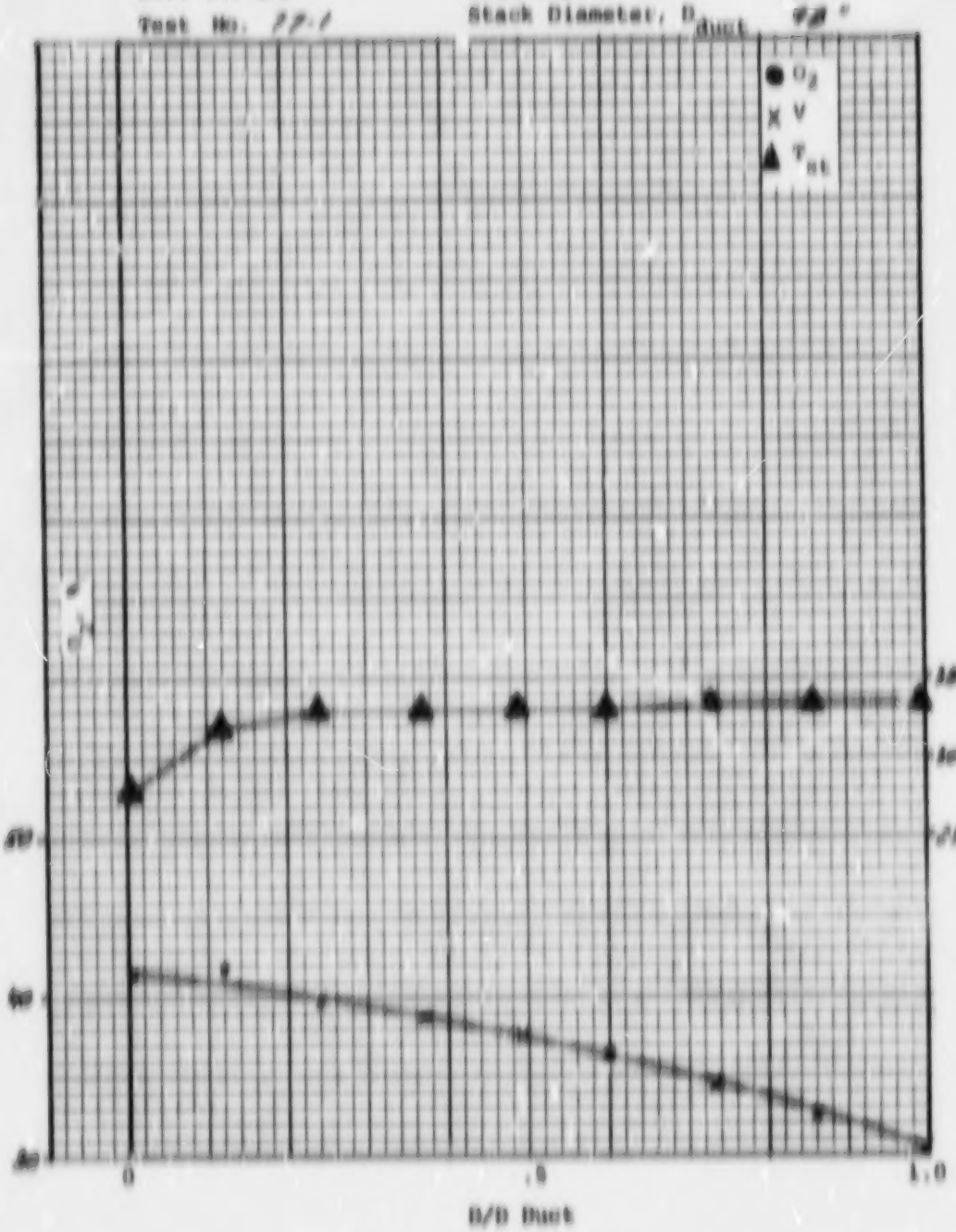
STACK TRAVERSE DATA

Location No. [illegible]
Unit No. [illegible]
Test No. [illegible]

Fuel [illegible]
Load [illegible] lb/hr
Stack Diameter, D_{duct} [illegible]"



TENNESSEE GAS PIPELINE COMPANY
GAS SAMPLE ANALYSIS

PRODUCER: ALABAMA-TENN. NAT. GAS CO.
LOCATION: CORINTH MISSISSIPPI SALES
STATION NO.(COLS 1-6) 8- 58- 1 COMPOSITE CODE(COL 7)
ANALYSIS DATE(COL. 61-66) 9 6 73

ANALYSIS	KEYPUNCH COLUMN	MOL FRACTION	GPM 14.695PSIA AT 60 F	SP.GR. AT 60 F (AIR=1)
CARBON DIOXIDE	8-11	0.0098		0.0141
NITROGEN	12-15	0.0083		0.0088
OXYGEN	16-19	0.0000		0.0000
METHANE	20-23	0.9501	16.273	0.5317
ETHANE	24-27	0.0248	0.688	0.0853
PROPANE	28-31	0.0039	0.109	0.0060
ISO-BUTANE	32-35	0.0011	0.037	0.0023
N-BUTANE	36-39	0.0007	0.023	0.0014
ISO-PENTANE	40-43	0.0003	0.010	0.0008
N-PENTANE	44-47	0.0002	0.008	0.0005
HEXANES PLUS	48-51	0.0000	0.000	0.0000
TOTAL		1.0000	17.081	0.5843

COMPOSITE CODES
1=GREEN BRANCH LINE 4=MAIN VALLEY LINE 7=DELTA LINE(V-510 TO V-660)
2=MAIN VALLEY LINE 5=AK LINE 8=MAIN LINE(ST.1 TO ST.87)
3=DEAN(1-8) 6=KP LINE 9=TOTAL SYSTEM

FIELD DATA
PRES: 717.0PSI TEMP 88.0F SP.GR: 0.5860 BTU 0.
HEAD.P: 0. F AT 0. PSI HYD.D.P. 0. F AT 0. PSI
TAKEN BY WEDGEWORTH DATE 8 28 73 BOMB NO

LAB DATA
SP.GR.(CAL.) 0.5830 SP.GR.(C/L.U.) 0.5843 *BTU(DRY) 1038.
ANALYSIS NO 68716 DEV.TEST NO. 0- 0 *BTU(WET) 1016.

ANALYSIS BY LEWIS

REMARKS: ABOVE ERROS INDICATE DATA NOT AVAILABLE
*BTU / CU FT AT 14.73 PSIA AT 60F
QUARTERLY ANALYSIS**
AR

INDUSTRIAL BOILER DESIGN DATA

Location No. 18 Test No. 29 31 Unit No. 2

Unit Description B & W stirling Boiler

Installation Date	1967
Steam Output (10^3 lb/hr)	500
Design Pressure (psig)	1050
Final Steam Temp (°F)	900
Furnace Type	Watertube
Furnace Size L-W-H (ft)	30 · 21 · 80 ?
Furnace Area (ft^2)	25400
Furnace Volume (ft^3)	18.6
Burner Description	2 RCW Kenics Riley Oil Burners
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	5'-6"
Test Fuel	#6 Oil & Coal
Fuel Temp at Burner (°F)	210 for Oil, ~ 170 for Coal
Primary Air Temp (°F)	~ 440
Stack Temp (°F)	~ 430

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 18

Unit 6

Fuel Coal

Test No.	21-1						
Test Type	Boiler						
Test Load (10^3 lb/hr)	400						
Excess O_2 (%)	7.8						
NO (ppm)*	578						
NO (ppm)*	594						
O_2 dry (%)	10						
CO (ppm)*	0						
HC (ppm)*	0						
SO_2 (ppm)*	1008						
SO_2 (ppm)*	1509						
Total Part. (lb/MBtu)	10.27						
Solid Part. (lb/MBtu)	10.23						
Boiler Efficiency (%)	81						
Smoke Spot No.	———						
Opacity (%)	———						
Final Stm Pres. (psig)	850						
Final Stm Temp. (°F)	805						
Combus. Air Temp. (°F)	445						
Stack Temp. (°F)	485						
Fuel Flow #/hr	52,252						
Fuel Temp. (°F)	———						
Fuel Pres. (psig)	———						
Furnace Pres. (in. H_2O)	-0.1						
Register (% open)	———						

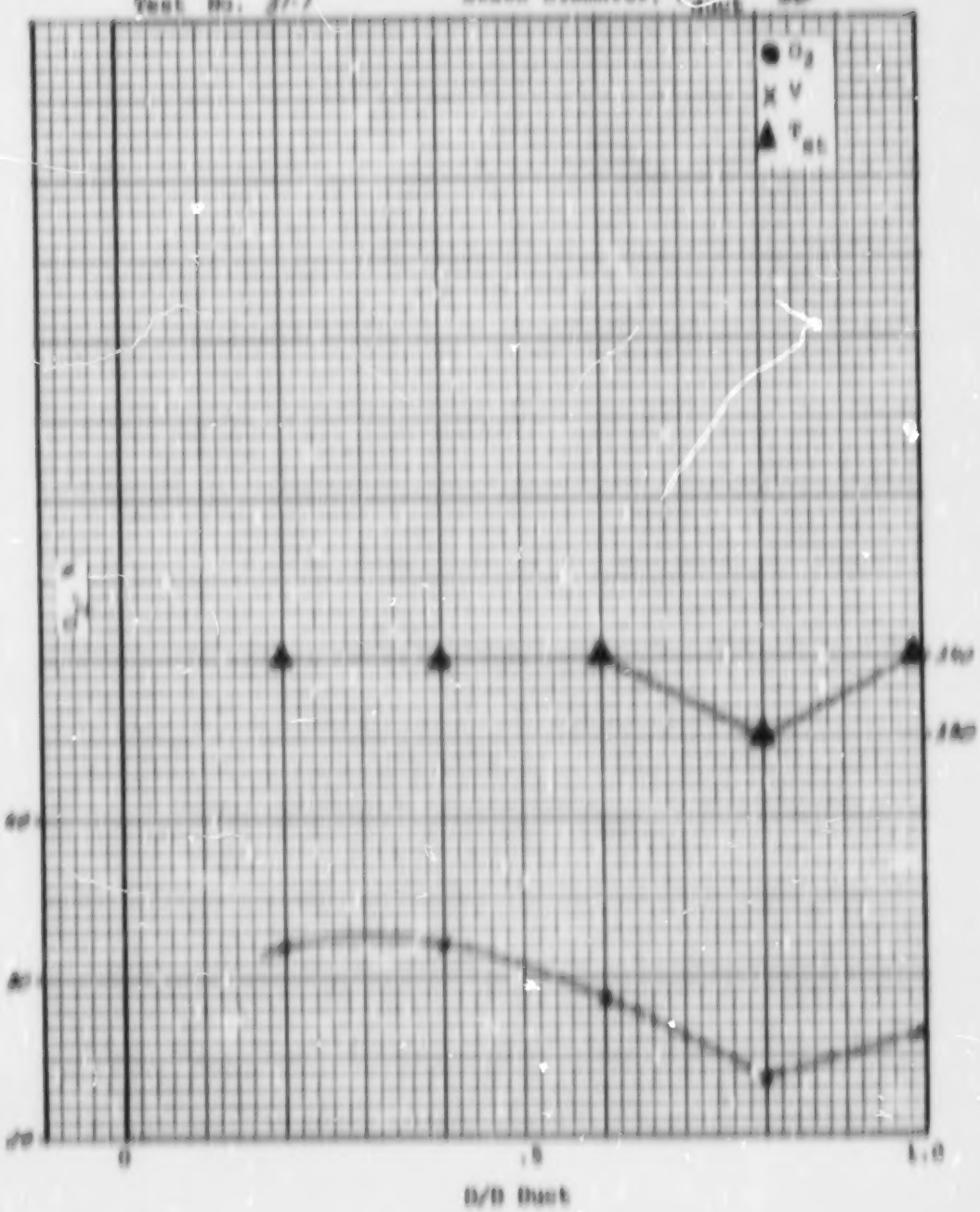
*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. /8 Fuel Coal

Unit No. 2 Load [illegible] lb/hr

Test No. 81-1 Stack Diameter, D [illegible]



REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

1351 N. FIGUEROA STREET
LOS ANGELES 90042
AREA CODE 213 · 222-1181
CABLE: TRUELAB

CLIENT: KVB Equipment Corp.
17332 Irvine Blvd.
Tustin, Calif. 92680
Attn: Glenn Gato

DATE: May 23, 1974

RECEIVED: May 1, 1974

SAMPLE: 5 Coal Samples and 2 Fuel Oil Samples, as shown.

LABORATORY NO. 122116

P.O.: 1700-43

INVESTIGATION: Analysis and tests as requested
Location 13
Unit 2
Test 31

RESULTS

SAMPLE IDENTIFICATION:

4. Coal - Test #31, Unit 2, 3-28-74 # 45 + 17 tests

The results of the coal analysis are as follows:

	No. 4
As Received:	
Moisture, %	7.28
Carbon, %	63.76
Hydrogen, %	4.36
Nitrogen, %	1.35
Sulfur, %	1.68
Ash, %	17.17
Oxygen, % (By difference)	4.30

(Continued)

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 18

Unit 4

Fuel #6 Oil & 15.7 Tons/Hr Coal

Test No.	29-1	29-2	29-3	29-4	29-5	29-6	29-7
Test Type	Without Air	Without Air	Without Air	Normal	Base	Full Load	Over Air
Test Load (10^3 lb/hr)	425	420	410	420	400	360	400
Excess O_2 (%)	9.0	8.2	6.9	6.2	7.6	7.3	8.8
NO_x (ppm)*	240	212	205	188	211	240	239
NO (ppm)*	214	224	198	176	205	230	230
$(O)_2$ dry (%)	10	10	11	11.2	9.2	9.2	10
CO (ppm)*	0						
HC (ppm)*	21	15	13	6	7	5	9
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)				79	78		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	840	850	825	840	810	830	850
Final Stm Temp. (°F)	860	850	850	855	850	855	860
Combus. Air Temp. (°F)	440	425	430	440	435	425	425
Stack Temp. (°F)	440	425	430	440	435	425	425
Fuel Flow (gal/Min)	53	60	58	74	68	52	57
Fuel Temp. (°F)	252	250	255	255	250	250	250
Fuel Pres. (psig)	62	58	54	90	64	50	67
Furnace Pres. (in. H_2O)	-.01	0	-.005	-.005	-.01	-.015	-.01
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

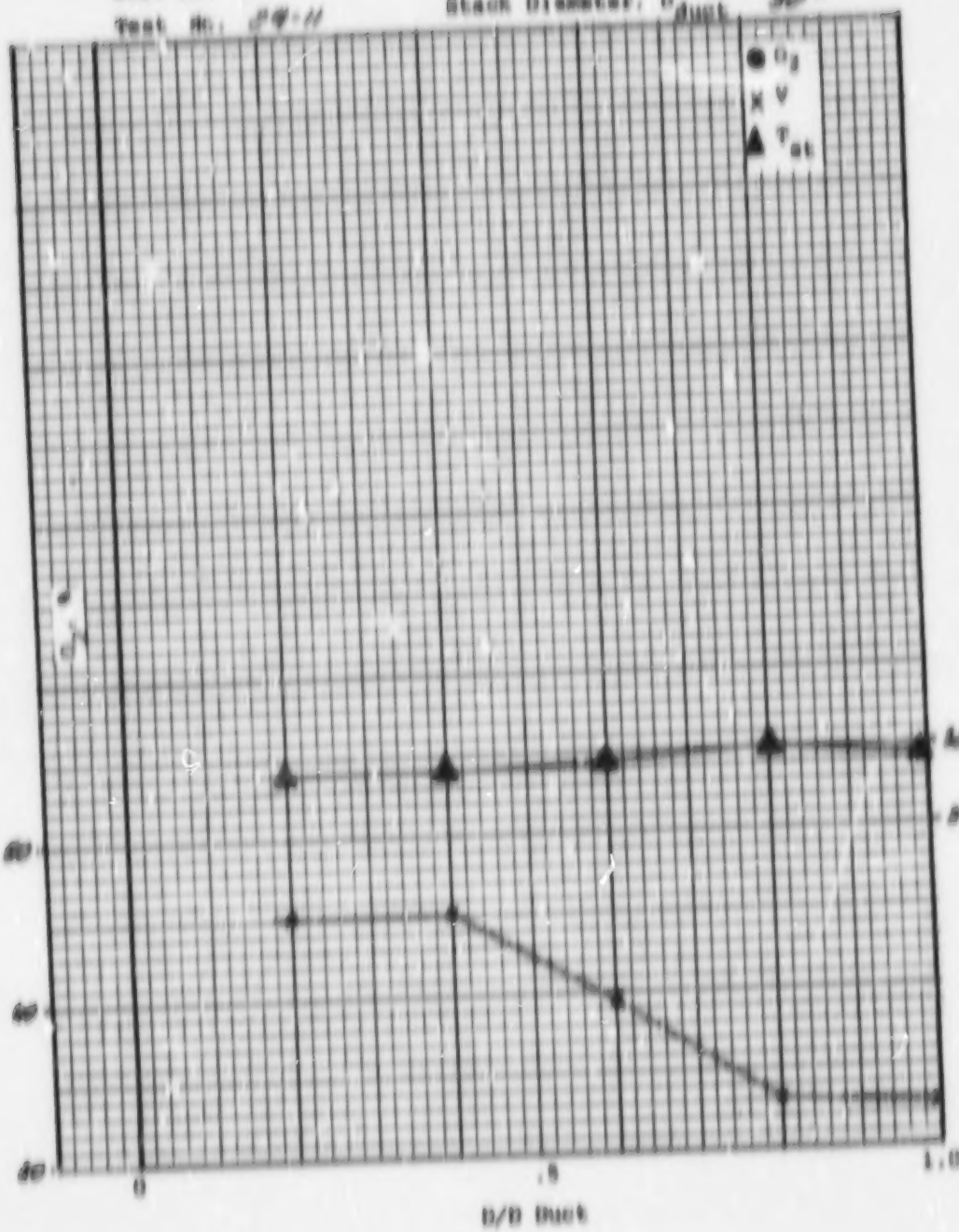
Test No.	[illegible]	[illegible]	[illegible]	[illegible]			
Test Type	[illegible]	[illegible]	[illegible]	[illegible]			
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]			
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]			
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
$(O)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]			
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]			
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]			
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]			
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]			
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]			
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]			
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]			
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]			
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]			

*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. 18
Unit No. 6
Test No. 6-9-11

Fuel clean ~~d~~ 12.8" Texas Lignite Charlie
Load 6 Pul, clean lb/hr
Stack Diameter, D duct 36" "



TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 · 225-1864
CABLE: TRUELABS

CLIENT: KVB Equipment Corp.
17332 Irvine Blvd.
Tustin, Calif. 92680
Attn: Glenn Cate

DATE: May 23, 1974

RECEIVED: May 1, 1974

SAMPLE: 5 Coal Samples and 2 Fuel Oil Samples, as shown.

LABORATORY NO. 132116

P.O.: 1700-43

INVESTIGATION: Analysis and tests as requested

Location AF
Unit 2
Test #9

RESULTS

SAMPLE IDENTIFICATION:

6 Oil - Test #19, 5-29-74

SEE FOLLOWING PAGE
FOR SAMPLE ANALYSIS

(Continued)

Heat of Combustion:
Gross, BTU/lb
Net, BTU/lb

Dry Basis:
Carbon, %
Hydrogen, %
Nitrogen, %
Sulfur, %
Ash, %
Oxygen, %
(by difference)

Heat of Combustion:
Gross, BTU/lb
Net, BTU/lb

The results of the oil analysis are as follows:

	NO. 6
Carbon, %	85.56
Hydrogen, %	11.00
Nitrogen, %	0.46
Sulfur, %	2.43
Ash, %	0.12
Oxygen, % (by difference)	0.43
Carbon Residue, % (Conradson Carbon)	9.55
Heat of Combustion:	
Gross, BTU/lb	18,330
Net, BTU/lb	17,330
API Gravity at 30°C	13.6
Viscosity, SSU, at 40°C	7560

Locations 15
Shed 2
Test 29

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Ignas Bendinskis
Supervisor, Air Pollution Testing

INDUSTRIAL BOILER DESIGN DATA

Location No. 18 Test No. 158 - 159 Unit No. 2

Unit Description B & W stirling Boiler

Installation Date	1967
Steam Output (10^3 lb/hr)	500
Design Pressure (psig)	1050
Final Steam Temp (°F)	900
Furnace Type	Watertube
Furnace Size L-W-H (ft)	86 · 20 · 20
Furnace Area (ft^2)	7360
Furnace Volume (ft^3)	34,900
Burner Description	6 B&W Pulv. Coal Burners 4 B Peabody Steam Atom. Oil Burners
Horiz. Burner Spacing (ft)	6
Vert. Burner Spacing (ft)	5.5
Test Fuel	Pulverized Coal & No. 6 Oil
Fuel Temp at Burner (°F)	180 for Oil, 150 for Coal
Primary Air Temp (°F)	420
Stack Temp (°F)	425

Comments: ① ② ③ coal/oil
④ ⑤ ⑥ coal/oil
⑦ ⑧ ⑨ oil only

BOILER EMISSION MEASUREMENTS AND CONTROL NOX DATA

Location *[illegible]*

Unit *[illegible]*

Fuel *Coal*

Test No.	156-1	156-2	157-1	157-2	157-3	157-4	158-1
Test Type	No Air	Base	Low Load	No Air	H. Load	M. Air	Low Air
Test Load (10^3 lb/hr)	400	400	320	380	460	400	320
Excess O_2 (%)	9.4	8.6	9.6	9.4	8.6	10.1	8.1
NO_x (ppm)*	405	363	322	362	381	410	297
NO (ppm)*	386	337	300	326	364	430	280
O_2 dry (%)	9.0	8.6	9.0	8.8	9.6	8.4	10.0
CO (ppm)*	0	27	126		65	0	190
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)		0.06					
Solid Part. (lb/MBtu)		0.01					
Boiler Efficiency (%)		76	77		78		79
Smoke Spot No.		9	9	9	9	9	
Opacity (%)	20	100	100	80	100	100	
Final Stm Pres. (psig)	830	830	810	836	840	832	830
Final Stm Temp. (°F)	880	840	880	880	880	870	880
Combus. Air Temp. (°F)	430	430	425	425	428	430	440
Stack Temp. (°F)	430	420	420	430	435	430	435
Fuel Flow							
Fuel Temp. (°F)	150	140	140	140	140	150	150
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.11	-0.08	-0.10	-0.09	-0.095	-0.10	-0.08
Register (% open)	[illegible]						

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 13

Unit 2

Fuel Coal & Oil

Test No.	15T-1	15T-2	15T-3	15T-4			
Test Type	Normal Boiler Operation		←	Full Load Boiler Operation			
Test Load (10^3 lb/hr)	410	410	400	400			
Excess O_2 (%)	7.2	7.8	7.2	6.9			
NO_x (ppm)*	287	294	288	302			
NO (ppm)*	240	280	270	281			
CO_2 dry (%)	8.2	9.4	10	9.4			
CO (ppm)*	0	0	65	15			
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	76		79	79			
Smoke Spot No.	0.5	0.5	0.0				
Opacity (%)	20	20	20				
Final Stm Pres. (psig)	850	850	850	850			
Final Stm Temp. (°F)	860	860	860	860			
Combus. Air Temp. (°F)	450	450	450	450			
Stack Temp. (°F)	450	450	450	450			
Fuel Flow Oil GPH	26	26	26	26			
Fuel Temp. (°F)	Oil 150 Coal 150	150	150	150			
Fuel Pres. (psig) Oil	125	125	125	120			
Furnace Pres. (in. H_2O)	-0.1	-0.10	-0.1	-0.2			
Register (% open)	[redacted]	←	←	[redacted]			

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.	156-8			
Location No.	18			
Fuel Type	Coal			
Burner Type	Pulv			
Test Load (lb/hr x 10^3)	400			
Stack Temp ($^\circ$F)	300			
Stack Press. (in.H_2O)	10.5			
Impactor ΔP (in.H_2O)	9.13			
Gas Volume (cm^3)	61,600			
Impactor Flow ($cm^3 \cdot s^{-1}$)	514			
Sample Time (sec)	1200			
Orientation	Horizontal			
D_{50} Cyclone (μm)	10.4			
Cascade Impactor Stage Cut Points	1 (μm)	2.6			
	2 (μm)	1.4			
	3 (μm)	0.96			
	4 (μm)	0.48			
	5 (μm)	0.24			
Cyclone, Cascade Impactor, and Filter Catch	Cyclone (mg)	82.6			
	Stage 1 (mg)	37.7			
	Stage 2 (mg)	34.2			
	Stage 3 (mg)	8.82			
	Stage 4 (mg)	6.69			
	Stage 5 (mg)	8.04			
	Filter (mg)	0.236			
Total Catch (mg)		163			
Comments					

Location: [redacted]
Unit 2
Test No. 156 - 157

FUEL ANALYSIS SUMMARY

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Calcium Carbonate, %	Gravity, API °	Higher Heating Value Btu/lb	Btu/lb
105-101	#2 Oil	85.34	12.72	0.89	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
107-108	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
111-112	PS 300 (85 +10)	86.46	10.31	1.87	1.29	0.77	0.10	-	0.50	15.1	0.0426	18,333
116-121	#6 Oil	85.95	10.31	0.33	2.74	0.31	0.03	-	-	-	0.0433	18,313
126-130	#6 Oil	No Fuel Sample Obtained For Analysis										
131-133	Coal	62.50	5.21	12.51	1.15	0.83	10.5	7.39	-	-	0.0276	11,863
134-139	Coal	68.30	4.70	11.01	1.16	1.46	9.71	3.66	-	-	0.0286	12,293
136-159	Coal	69.09	4.67	8.10	1.36	1.50	14.48	1.37	-	-	0.0286	12,308
139	#6 Oil	85.44	11.35	0.003	2.80	0.33	0.070	-	12.33	15.8	0.0432	18,585
160-164	#2 Oil	87.14	12.71	-	0.31	0.013	<0.001	-	0.027	35.1	0.0451	19,390
165-168	Coal	63.42	4.84	9.85	1.05	0.94	12.7	4.15	46.2	-	0.0276	11,873
169	Coal	62.93	5.12	12.51	1.15	0.83	10.5	7.39	-	-	0.0276	11,863
170-175	#6 Oil	86.60	10.94	0.31	1.60	0.30	0.25	-	9.80	15.1	0.0434	18,660
176-179	#6 Oil	86.17	11.55	-	1.92	0.30	0.07	-	-	-	0.0436	18,773
180-189	#6 Oil	85.10	11.10	1.12	0.19	0.49	0.08	-	0.53	25.7	0.0446	19,227
195-196	#6 Oil	86.48	12.16	0.65	0.37	0.14	0.009	-	1.61	20.2	0.0450	19,365

INDUSTRIAL BOILER DESIGN DATA

Location No. 19 Test No. 27 Unit No. 1

Unit Description CE Furnace, Serial No. 10500-856

Installation Date	1950
Steam Output (10^3 lb/hr)	150
Design Pressure (psig)	850
Final Steam Temp (°F)	900
Furnace Type	Watertube
Furnace Size L-W-H (ft)	20-17-17
Furnace Area (ft^2)	1940
Furnace Volume (ft^3)	5800
Burner Description	5 Detroit Stoker Spreader Stokers
Horiz. Burner Spacing (ft)	3'
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burners (°F)	Ambient
Primary Air Temp (°F)	~150
Stack Temp (°F)	~330

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(O)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]							
SO_x (ppm)[a]	[illegible]						
SO_2 (ppm)[a]	[illegible]						
Total Part. (lb/MBtu)	[illegible]						
Solid Part. (lb/MBtu)	[illegible]						
Boiler Efficiency (%)	[illegible]			[illegible]			
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]						
Fuel Flow lb/hr	[illegible]						
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)							

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location /#

Unit /

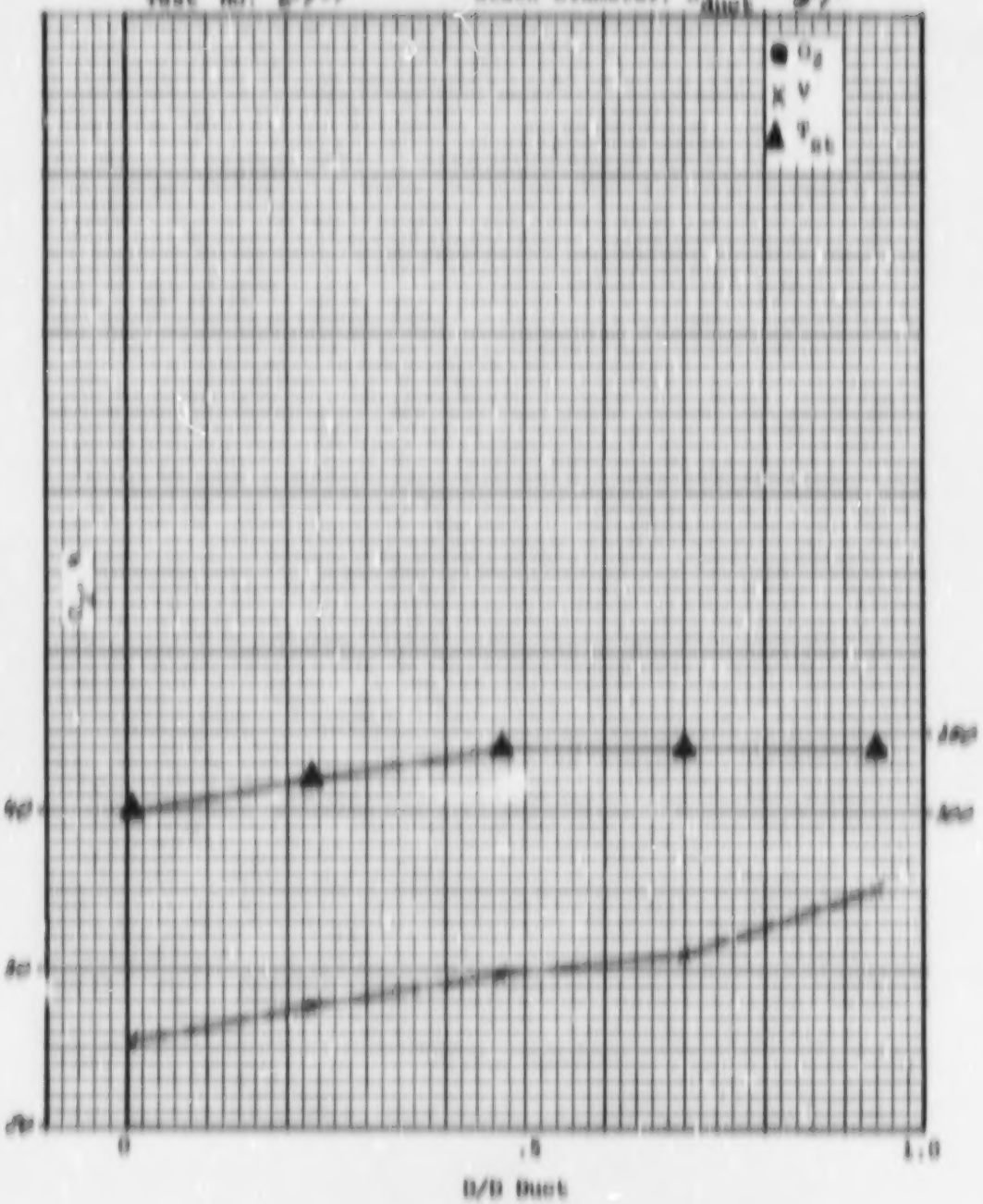
Fuel Coal

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
$(O)_2$ dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]
Unit No. 1 Load [illegible] lb/hr
Test No. [illegible] Stack Diameter, D_{duct} [illegible]



K V B ENGINEERING, INC.
17300 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-6020

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 8/5/74

SAMPLES: 2 Coal Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000

ANALYZED: 7/24/74

INVESTIGATION: As Requested

LABORATORY NO: 74121-C

Sample Identification:

No. 1 Test No. 27-1; Boiler #1, 6/13/74.

	No. 1
Carbon, %	75.02
Hydrogen, %	5.50
Ash, %	7.99
Moisture, %	3.51
Carbon Residue, %	81.07
Heat of Combustion:	
Gross, BTU/lb.	13,110
Net, BTU/lb.	12,600
Sulfur, %	1.50
Nitrogen, %	1.33
Oxygen, % (by difference)	7.03

KVB

Location 10
Unit 1
Test 27

	Parts Per Million in Coal
	No. 1
Silicon	39,000
Iron	7,000
Aluminum	15,000
Magnesium	960
Calcium	2,400
Titanium	660
Barium	140
Boron	37
Manganese	37
Lead	40
Gallium	14
Tin	26
Nickel	14
Beryllium	0.3
Vanadium	14
Copper	24
Sodium	730
Silver	trace
Potassium	trace
Zirconium	22
Cobalt	7.3
Strontium	210
Chromium	30

Respectfully submitted,

A. R. Briensa

A.R. Briensa
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 14 Test No. 28 Unit No. 4

Unit Description Riley Stoker Furnace, Serial No. 68058

Installation Date	1969
Steam Output (10^3 lb/hr)	200
Design Pressure (psig)	850
Final Steam Temp (°F)	780
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	25'-20'-20'
Furnace Area (ft^2)	3000
Furnace Volume (ft^3)	12625'
Burner Description	6 Riley Turbulator Stokers
Horiz. Burner Spacing (ft)	9
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	450

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*							
SO_x (ppm)*	[illegible]						
SO_2 (ppm)*	[illegible]						
Total Part. (lb/MBtu)		[illegible]					
Solid Part. (lb/MBtu)		[illegible]					
Boiler Efficiency (%)		[illegible]				[illegible]	[illegible]
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]						→
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow #/hr	[illegible]						
Fuel Temp. (°F)	[illegible]						→
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 4

Fuel Coal

Test No.							
Test Type	Normal Air	Normal Air	Normal Air	Air Cooled	Normal Air	Coal 40%	Coal 40%
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*							
SO_2 (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							[illegible]
Solid Part. (lb/MBtu)							[illegible]
Boiler Efficiency (%)				[illegible]			
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow							
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]			
Test Type	[illegible]	[illegible]	[illegible]	[illegible]			
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]			
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]			
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
$(X)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]			
(X) (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]			
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]			
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]			
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]			
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]			
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]			
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Flow	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]			
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]			
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]			

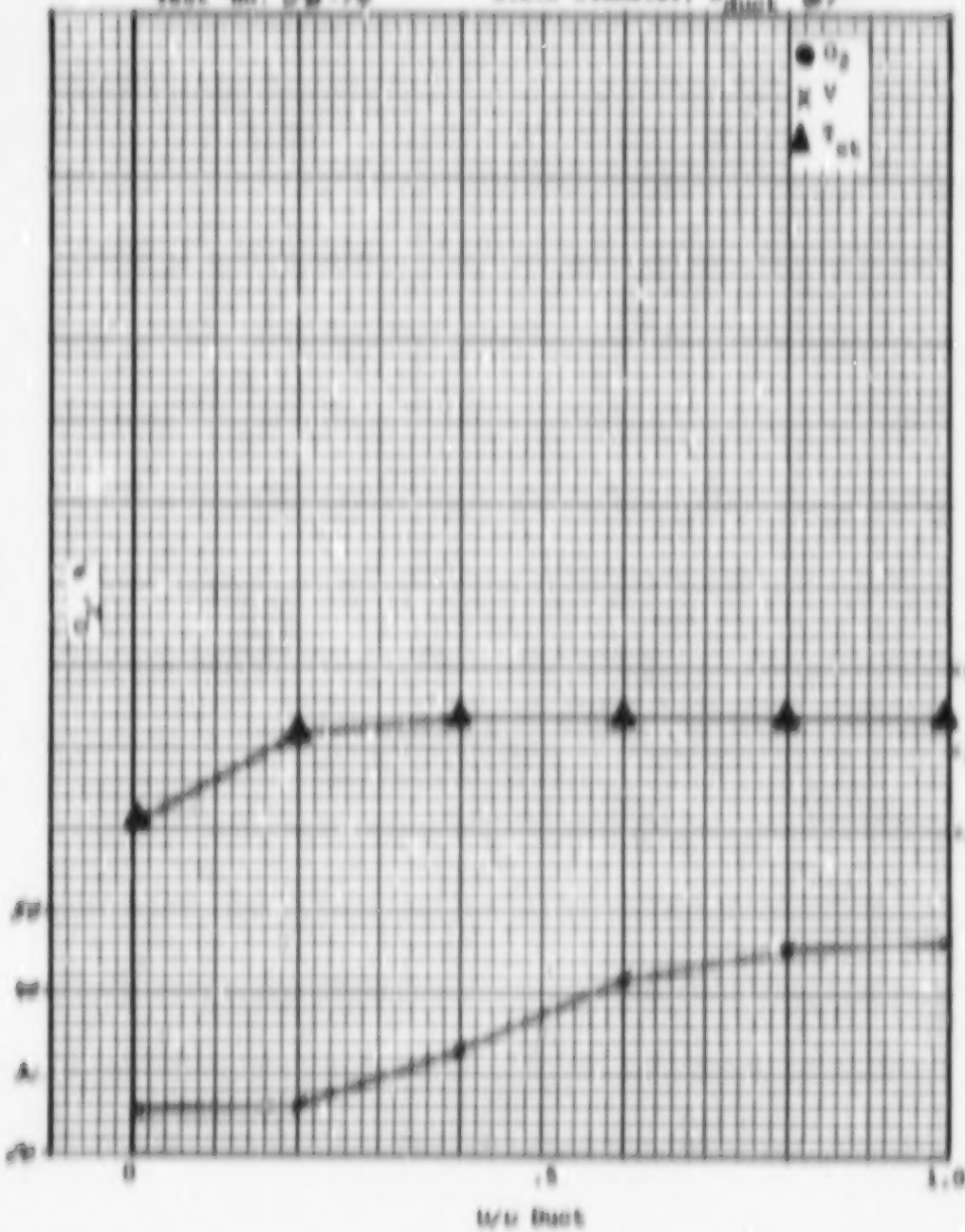
*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. /4 Fuel c'oa/

Unit No. 4 Load /4 [illegible] lb/hr

Test No. c'4-/4 Stack Diameter, D_{duct} 6/"



K V B ENGINEERING, INC.
17000 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-9000

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, Calif.
Attn: G. Cato

DATE: 7/17/74

SAMPLES: 5 Coal Samples

RECEIVED: 6/18/74

KVB CHARGE NO.: 6000

ANALYZED: 6/25/74

INVESTIGATION: As Requested

LABORATORY NO: 741190

Sample Identification:
No. 1 Test No. 2802; April 1st 1974
No. 2 Test No. 28-10; Boiler 6, Low NOx firing,
April 10, 1974

	No. 1	No. 2
Carbon, %	73.83	70.51
Hydrogen, %	5.20	5.16
Sulfur, %	0.86	0.83
Nitrogen, %	1.80	1.79
Ash, %	10.36	15.55
Oxygen (by difference)	7.95	6.87
Moisture, %	1.53	1.76
Carbon Residue, %	59.37	60.11
Heat of Combustion:		
Gross, Btu/lb	13,320	11,850
Net, Btu/lb	12,940	11,370

The results of a spectrographic analysis for trace metals will be reported as soon as available.

Location 14
Unit 4
Test 28

Respectfully submitted,

J. George Butler
Laboratory Director

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

6101 N. FIGUEROA STREET
LOS ANGELES 90042
AREA CODE 213 | 255-1060
CABLE: TRUELABS

CLIENT: KVB Engineering
17332 Irvine Blvd.
Tustin, CA 92680
Attn: Hans Buening

DATE: August 7, 1974

RECEIVED: August 1, 1974

LABORATORY NO. 1051

SAMPLE: 4 Coals previously submitted for other analyses marked as shown

P.O. No. 6000

INVESTIGATION: Determination of density

RESULTS

	Density (g/ml.)
Test No. 78-2; Better #4, 4/17/74	1.349

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Alvin E. May

Alvin E. May
Director of Laboratories

K V B ENGINEERING, INC.
17988 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-6060

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 7/19/74

SAMPLES: 5 Coal Samples

RECEIVED: 6/18/74

KVB CHARGE NO.: 6000

ANALYZED: 6/25/74

INVESTIGATION: Spectrographic Analysis of Coal - Supplement to 741190

LABORATORY NO: 741190

Sample Identification:

No. 1 Test No. 28-2; Boiler No. 4, April 17, 1974

No. 2 Test No. 28-18; S.C., Boiler 4, Low NOx firing, April 19, 1974

Parts Per Million In Coal

	No. 1	No. 2
Silicon	29,000	50,000
Aluminum	16,000	19,000
Iron	8,600	6,300
Calcium	1,200	1,100
Magnesium	940	1,400
Titanium	730	1,000
Copper	18	16
Barium	100	120
Beryllium	1.8	1.6
Boron	13	10
Manganese	40	48
Lead	37	trace
Nickel	14	14
Tin	37	14

ND = not detected

Location 19
Unit 4
Test #3

KVB

Parts Per Million in Coal

	No. 1	No. 2
Vanadium	14	19
Silver	ND	ND
Sodium	660	590
Cobalt	6.8	8.9
Zirconium	26	33
Strontium	130	110
Potassium	740	trace
Chromium	33	39

ND = not detected

This completes the laboratory report for the five coal samples.

Respectfully submitted,

KVB/Tri-Con, Inc.

J. George Sotter,
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 16 Test No. 8 Unit No. AFB-1

Unit Description B&W Sterling Boiler, Type N-16

Installation Date	1968
Steam Output (10^3 lb/hr)	16.5
Design Pressure (psig)	150
Final Steam Temp (°F)	Sat
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	10 · 10 · 9
Furnace Area (ft^2)	864
Furnace Volume (ft^3)	1620
Burner Description	1 Roy Rotary Cup Burn. Type AA-12
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	NSF · 0.1 (0.6 wt.)
Fuel Temp at Burner (°F)	~ 120
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 600

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL 'XXM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
CO_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (lbs/hr)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 15

Unit AFB-1

Fuel NSF - 0.1 (#5 0.1)

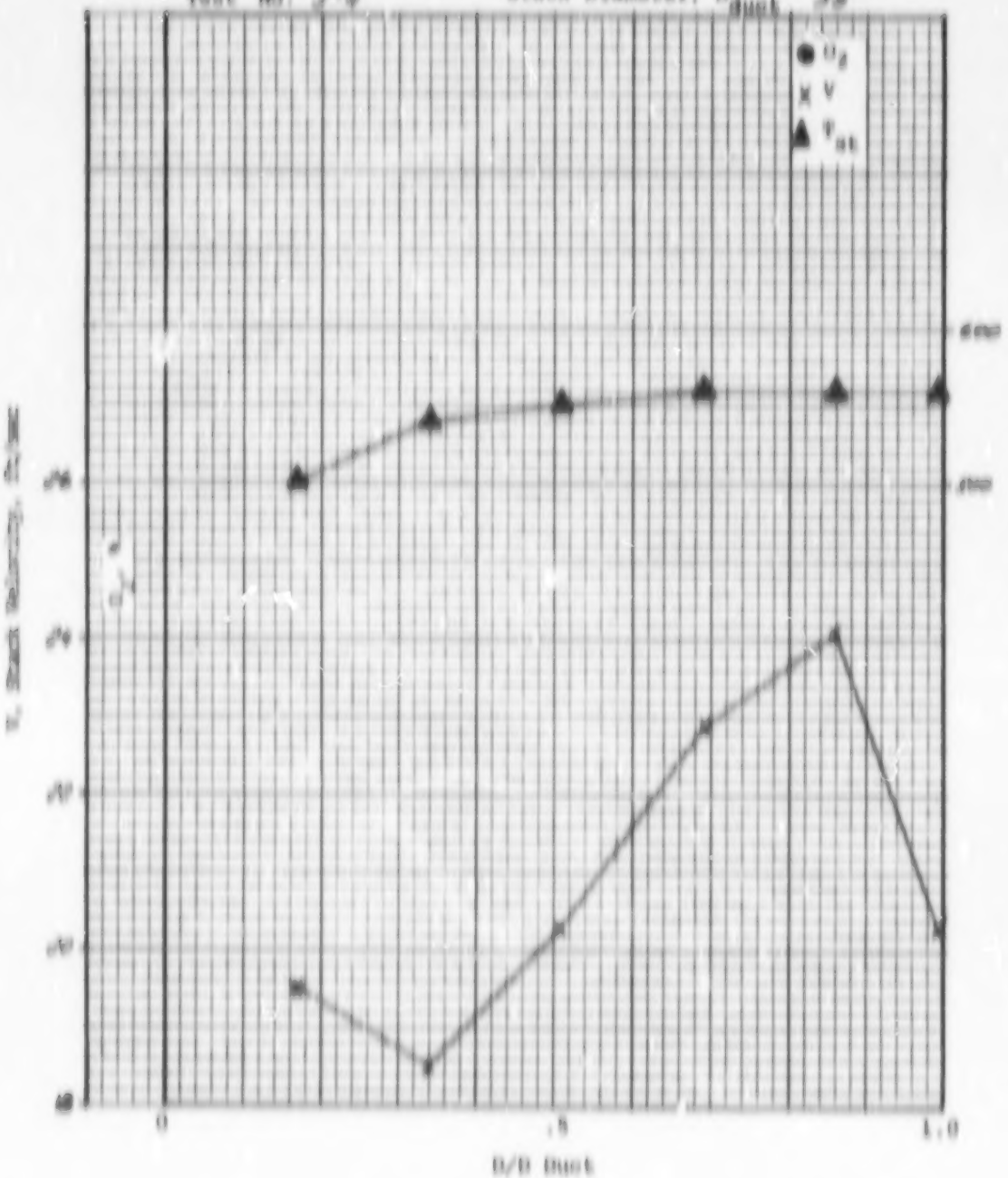
Test No.	3-B	3-9					
Test Type	ABMA A.1	ABMA A.1					
Test Load (10^3 lb/hr)	10.7	12.6					
Excess O_2 (%)	10.2	8.2					
NO_x (ppm)*	231	201					
NO (ppm)*	227	201					
$(O)_2$ dry (%)	8.4	10.2					
(O) (ppm)*	0	0					
NO' (ppm)*	----	----					
NO_2 (ppm)*	----	----					
SO_2 (ppm)*	----	----					
Total Part. (lb/MBtu)	----	0.1262					
Solid Part. (lb/MBtu)	----	0.0980					
Boiler Efficiency (%)	----	----					
Smoke Spot No.	----	----					
Opacity (%)	----	----					
Final Stm Pres. (psig)	1510	1410					
Final Stm Temp. (°F)	500°	503°					
Combus. Air Temp. (°F)	Amb.	Amb.					
Stack Temp. (°F)	610°	630°					
Fuel Flow	----	MAF ?					
Fuel Temp. (°F)	127	125					
Fuel Pres. (psig)	250	250					
Furnace Pres. (in. H_2O)	----	----					
Register (% open)	----	----					

*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. [illegible]
Unit No. [illegible]
Test No. [illegible]

Fuel [illegible]
Load [illegible]
Stack Diameter, D_{duct} [illegible]



TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

6101 N. FIGUEROA STREET
LOS ANGELES 90042
AREA CODE 213 · 258-1861
CABLE: TRUELABS

CLIENT: KVB Equipment Corp.
17332 Irvine Blvd.
Tustin, Calif. 92680
Attn: Glenn Gato

DATE: May 23, 1974

RECEIVED: May 1, 1974

SAMPLE: 5 Coal Samples and 3 Fuel Oil Samples, as shown.

LABORATORY NO. 122116

P.O.: 1700-43

INVESTIGATION: Analysis and tests as requested

Evaporation 48°
Acid 100 cc
Test 3

RESULTS

SAMPLE IDENTIFICATION:

7. Oil - Test #3, , Boiler #1, 4-9-74

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

(Continued)

The results of the oil analysis are as follows:

	NO. 1	Composite #3 Test 3
Carbon, %	84.62	
Hydrogen, %	11.68	
Nitrogen, %	0.26	
Sulfur, %	1.59	
Ash, %	0.065	
Oxygen, % (by difference)	1.99	
Carbon Residue, % (Conradson Carbon)	6.92	
Heat of Combustion:		
Gross, BTU/lb	18,730	
Net, BTU/lb	17,660	
API Gravity at 80°F	21.9	
Viscosity, SSU, at 40°C	298	

Respectfully submitted,

RUSSDAIL LABORATORIES, INC.

Agnes Bandstulis
Supervisor, Air Pollution Testing

INDUSTRIAL BOILER DESIGN DATA

Location No: 15 Test No: A5 Unit No: B2-A2

Unit Description B&W Integral Furnace,

Installation Date	1971
Steam Output (10^3 lb/hr)	60
Design Pressure (psig)	925
Final Steam Temp (°F)	825
Furnace Type	Watertube
Furnace Size L-W-H (ft)	16 - 15 - 28
Furnace Area (ft^2)	1852
Furnace Volume (ft^3)	5040
Burner Description	7 Westinghouse Underfeed Stokers
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	460

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL RUN DATA

Location: [illegible]

Unit: [illegible]

Fuel: [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*At 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 16

Unit 52-10

Fuel Coal

Test No.	16-B	16-C	16-D	16-H	16-A*	16-G	16-F
Test Type	M. Load	Low Air	Low Air	M. Air	Base	M. Air	Low Air
Test Load (10^3 lb/hr)	80	92	93	96	93.5	96	91.5
Excess O_2 (%)	6.1	6.7	4.9	7.0	6.6	8.2	3.9
NO$_x$ (ppm)[a]	319	179	192	264	300	278	238
NO (ppm)[a]	293	176	192	257	280	269	232
O_2 dry (%)	12.8	12.4	14	12	12.1	11.8	11.4
CO (ppm)[a]	0	0	0	0	0	0	0
HC (ppm)[a]							
SO$_x$ (ppm)[a]							
SO$_2$ (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	79		77		76		
Bacharach Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	910	912	911	910	915	910	910
Final Stm Temp. (°F)	760	760	760	760	760	760	760
Combus. Air Temp. (°F)	74	75	75	78	78	78	78
Stack Temp. (°F)	615	580	592	610	610	580	570
Fuel Flow #/h/#/h	7.8	8.8	8.4	8.8	8.6	8.3	8.1
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-.005	-.007	-.007	-.007	-.006	-.007	-.010
Register (% open)							

[a] at 10 O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]
Unit [illegible]
Fuel [illegible]

Test No.	[illegible]	[illegible]					
Test Type	[illegible]	[illegible]					
Test Load (10^3 lb/hr)	[illegible]	[illegible]					
Excess O_2 (%)	[illegible]	[illegible]					
NO_x (ppm)*	[illegible]	[illegible]					
NO (ppm)*	[illegible]	[illegible]					
O_2 dry (%)	[illegible]	[illegible]					
CO (ppm)*	[illegible]	[illegible]					
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		[illegible]					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]					
Final Stm Temp. (°F)	[illegible]	[illegible]					
Combus. Air Temp. (°F)	[illegible]	[illegible]					
Stack Temp. (°F)	[illegible]	[illegible]					
Fuel Flow [illegible]	[illegible]	[illegible]					
Fuel Temp. (°F)	[illegible]	[illegible]					
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	[illegible]	[illegible]					
Register (% open)							

*at 3% O_2 dry

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

[illegible] FIGUEROA STREET
LOS ANGELES [illegible]
AREA CODE 213 · [illegible]
CABLES: TRUELAB

CLIENT: KVB Equipment Corp.
17332 Irvine Blvd.
Tustin, Calif. 92680
Attn: Glenn Cate

DATE: May 23, 1974

RECEIVED: May 1, 1974

SAMPLE: 3 Coal Samples and 2 Fuel Oil Samples, as shown.

LABORATORY NO. 122116

P.O.: 1700-43

INVESTIGATION: Analysis and tests as requested
Location 10"
Unit 32-10
Test 4b 16

RESULTS

SAMPLE IDENTIFICATION:

3. Coal - Test #16, , Boiler #10 & 11, 4-1-74

The results of the analysis are as follows:

	No. 3
As Received:	
Moisture, %	10.54
Carbon, %	67.60
Hydrogen, %	4.51
Nitrogen, %	1.40
Sulfur, %	0.86
Ash, %	9.51
Oxygen, % (by difference)	5.70

(Continued)

NO. 5

Heat of Combustion:	
Gross, BTU/lb	11,610
Net, BTU/lb	11,190
Dry Basis:	
Carbon, %	75.43
Hydrogen, %	5.04
Nitrogen, %	1.56
Sulfur, %	0.96
Ash, %	10.63
Oxygen, % (by difference)	6.38
Heat of Combustion:	
Gross, BTU/lb	12,980
Net, BTU/lb	12,510

Location 15"
Card 32-40
Test #7 16

Respectfully submitted,

RUESDAIL LABORATORIES, INC.

Agnes Randolette
Agnes Randolette
Supervisor, Air Pollution Testing

260

INDUSTRIAL BOILER DESIGN DATA

Location No. 15 Test No. 27 Unit No. B&W-15

Unit Description B & W Integral Furnace,

Installation Date	1943
Steam Output (10^3 lb/hr)	60
Design Pressure (psig)	425
Final Steam Temp (°F)	625
Furnace Type	Watertube
Furnace Size L-W-H (ft)	16 - 15 - 20
Furnace Area (ft^2)	1852
Furnace Volume (ft^3)	5040
Burner Description	2 Westinghouse Underfeed Stokers
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	480

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)						[illegible]	
Solid Part. (lb/MBtu)						[illegible]	
Boiler Efficiency (%)						[illegible]	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)							

*at 10 % O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Coal

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)[a]							
NO (ppm)[a]							
CO_2 dry (%)							
CO (ppm)							
HC (ppm)[a]							
SO_x (ppm)[a]							
SO_2 (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Coal

Test No.	17-18						
Test Type	Full Air						
Test Load (10^3 lb/hr)	40						
Excess O_2 (%)	7.0						
NO_x (ppm)*	602						
NO (ppm)*	196						
CO_2 dry (%)	12						
CO (ppm)*	418						
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	75						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	412						
Final Stm Temp. (°F)	678						
Combus. Air Temp. (°F)	Amb						
Stack Temp. (°F)	480						
Fuel Flow A/B/AA	0.1						
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.00						
Register (% open)							

*at 1% O_2 dry

EXHIBIT

TRUESDAIL LABORATORIES, INC.

CHEMISTS · MICROBIOLOGISTS · ENGINEERS
RESEARCH · DEVELOPMENT · TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 · 225-1544
CABLE: TRUELABS

CLIENT: KVB Equipment Corp.
17332 Irvine Blvd.
Tustin, Calif. 92680
Attn: Glenn Cato

DATE: May 23, 1974
RECEIVED: May 1, 1974
LABORATORY NO. 122116

SAMPLE: 9 Coal Samples and 2 Fuel Oil Samples, as shown.

P.O.: 1700-43

INVESTIGATION: Analysis and tests as requested

Location 15
Coal 12-13
Test No 17

RESULTS

SAMPLE IDENTIFICATION:

#5, Coal - Test #16, Boiler #10 & 13, 4-5-74

The results of the coal analysis are as follows:

	NO. 5
As Received:	
Moisture, %	0.34
Carbon, %	67.68
Hydrogen, %	4.51
Nitrogen, %	1.41
Sulfur, %	[illegible]
Ash, %	[illegible]
Oxygen, % (by difference)	[illegible]

(Continued)

	No. 5
Heat of Combustion:	
Gross, BTU/lb	11,610
Net, BTU/lb	11,190
Dry Basis:	
Carbon, %	75.41
Hydrogen, %	5.04
Nitrogen, %	1.56
Sulfur, %	0.96
Ash, %	10.61
Oxygen, % (by difference)	6.38
Heat of Combustion:	
Gross, BTU/lb	12,980
Net, BTU/lb	12,510

Location: 15"
Unit 82-18
Test #9 17

Respectfully submitted,

RUSSDAIL LABORATORIES, INC.

Agnes Mendzuilla
Supervisor, Air Pollution Testing

INDUSTRIAL BOILER DESIGN DATA

Location No. 15 Test No. 86 Unit No. 2-1

Unit Description Superior Furnace, Serial No. 84 A'C 8V@C

Installation Date	1958
Steam Output (10^3 lb/hr)	17
Design Pressure (psig)	115
Final Steam Temp (°F)	340
Furnace Type	Firetube
Furnace Size L-W-H (ft)	34 0 · 20
Furnace Area (ft^2)	230
Furnace Volume (ft^3)	180
Burner Description	1 Superior Rotary Cup Gas Mod/Fir'ing
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	NSF · Oil
Fuel Temp at Burner (°F)	~ 140
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 400

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location /5

Unit 2-1

Fuel N/S F - 0.1

Test No.	20-1	20-2	20-3	20-4			
Test Type	Low Load	Mid 10	66 Mw Opt	Hi Load			
Test Load (10^3 lb/hr)	140	175	199	215			
Excess O_2 (%)	9.0	6.7	5.0	3.6			
NO_x (ppm)*	232	186	208	214			
NO (ppm)*	218	182	201	210			
CO_2 dry (%)	9.4	10.8	10.4	10.9			
CO (ppm)*	0	126	91	40			
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		82		78			
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1125	1250	1275	1250			
Final Stm Temp (°F)	590	748	815	900			
Combus. Air Temp. (°F)	Amb			"			
Stack Temp. (°F)	460	480	530	565			
Fuel Flow							
Fuel Temp. (°F)	167	157	153	153			
Fuel Pres. (psig)	2	3.2	4.9	6.6			
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

K V B ENGINEERING, INC.
17982 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8881

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cate

DATE: 7/23/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 6/26/74

KVB CHARGE NO.: 6000

ANALYZED: 7/18/74

INVESTIGATION: Spectrographic Analysis
Supplement to Lab No. 741190

LABORATORY NO: 741190

Sample Identification:

No. 8 Test 36;
April 11, 1974.

Boiler #1, Bldg. 8,

Locations 15"
Unit 2-1
Test 36

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

Location: [illegible]
Unit [illegible]
Test 86

KVB

	No. 8
Carbon, %	85.78
Hydrogen, %	11.90
Ash, %	0.015
Carbon Residue, %	7.48
Flash Point, °C	108
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb.	18,850
Net, Btu/lb.	17,740
API Gravity	23.3 at 70°F
Nitrogen, %	.28
Sulfur, %	1.72
Oxygen, %	.27
Viscosity at 40°C	175

* Sample Oil too dark to determine Aniline Point
** To be turned in at a later date

Respectfully submitted,
Harold W. Corbett
for J. George Sotter
Laboratory Director

Locations 15"
Cut 1 2-1
Test 86

KVB

Parts Per Million As Oil

	No. 8
Vanadium	200.
Nickel	0.8
Iron	6.6
Tin	1.5
Magnesium	15.
Silicon	14.
Manganese	0.36
Lead	3.1
Aluminum	1.6
Calcium	6.6
Molybdenum	0.18
Copper	0.064
Sodium	6.6
Zinc	9.4
Titanium	0.18
Cobalt	0.10
Strontium	ND
Chromium	0.72
Barium	ND
Phosphorus	31.
Silver	ND

ND = not detected
*There was insufficient ash for a spectrographic analysis.

Respectfully submitted,

J. George Fisher

J. George Fisher
Laboratory Director

INDUSTRIAL BOILER EMISSION DATA

Location No. 10 Test No. 10 Unit No. 2

Unit Description Lattin Boiler Waterbury Furnaces Type CA Stoker Model 1828 Serial No. M27980

Installation Date	1962
Steam Output (10^3 lb/hr)	60
Design Pressure (psig)	450
Final Steam Temp (°F)	750
Furnace Type	Underfeed
Furnace Size L-W-H (ft)	12 - 9 - 15
Furnace Area (ft^2)	98.8
Furnace Volume (ft^3)	2010
Burner Description	2 Forced Steam Atom. Burners, Model 28-1
Horiz. Burner Spacing (ft)	2' 6"
Vert. Burner Spacing (ft)	0
Test Fuel	#6 oil
Fuel Temp at Burner (°F)	180
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	420

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
$(X)_2$ dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (Gal/Hr)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 16

Unit 2

Fuel #6 @ 1

Test No.	10-8	10-9	10-10	10-11	10-12		
Test Type	Var. Air	Var. Air	Air Register	Air Register	Air Register		
Test Load (10^3 lb/hr)	45	50	51	52	48.5		
Excess O_2 (%)	6.0	5.2	5.2	4.5	3.9		
NO_x (ppm)*	210	215	232	219	178		
NO (ppm)*	209	203	228	218	177		
O_2 dry (%)	11.4	10	12.2	12.5	13.8		
CO (ppm)*	0	0	0	0	0		
HC (ppm)*							
SO_4 (ppm)*		488					
SO_2 (ppm)*		473					
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)					85		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)		253	254				
Final Stm Temp. (°F)	400	400	405	400	405		
Combus. Air Temp. (°F)	Amb.				"		
Stack Temp. (°F)	400	450	400	370	370		
Fuel Flow							
Fuel Temp. (°F)	180	180	171	177	180		
Fuel Pres. (psig)	41	40	40.5	42	43		
Furnace Pres. (in. H_2O)	-0.5	-0.4	-0.5	-0.4	-0.45		
Register (% open)	65-65	65-65	100/100	100-100	100-45		

*at 3% O_2 dry

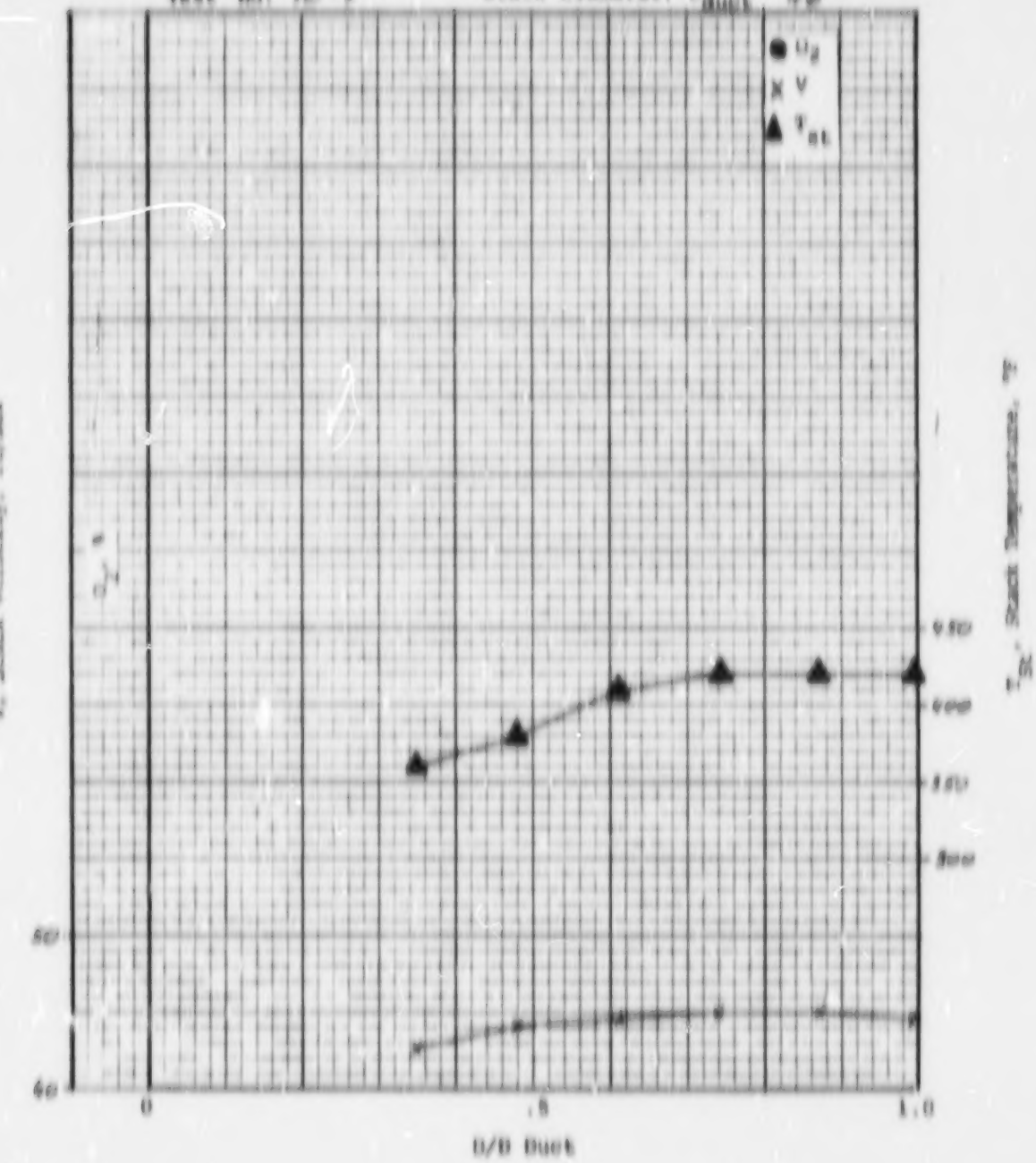
Bacharach Smoke No.
NO, ppm
CO, ppm
mg/dscm
Emissions for Industrial Boilers as a Function of Excess Oxygen
O_2, %

STACK TRAVERSE DATA

Location No. 16 Fuel #6 oil

Unit No. 2 Load 500,000 lb/hr

Test No. 10 Stack Diameter, D_{duct} 96"



K V B ENGINEERING, INC.
17282 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-9851

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 7/23/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 6/26/74

KVB CHARGE NO.: 6000

ANALYZED: 7/18/74

INVESTIGATION: Spectrographic Analysis
Supplement to Lab No. 741190

LABORATORY NO: 741190

location 16
Unit 2
Test 10

Sample Identification:

No. 1 Test 10; Bld. 501,

, April 23, 1974.

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

KVB

Location: 16
Unit 2
Test 10

	No. 1
Carbon, %	85.89
Hydrogen, %	11.87
Ash, %	0.043
Carbon Residue, %	5.23
Flash Point, °C	138
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb.	18,930
Net, But/lb.	17,850
API Gravity	20.5 at 70°F
Nitrogen, %	.29
Sulfur, %	**
Oxygen, %	**
Viscosity at 40°C, SSU	240

* Sample Oil too dark to determine Aniline Point

** To be turned in at a later date

Respectfully Submitted,

Dr. J. George Sorter
Laboratory Director

Location 16
Unit 2
Test 10

KVB

Parts Per Million As Oil

	No. 1
Vanadium	140
Nickel	15.
Iron	23.
Tin	6.4
Magnesium	11.
Silicon	6.0
Manganese	0.36
Lead	0.95
Aluminum	0.77
Calcium	22.
Molybdenum	0.11
Copper	0.056
Sodium	23.
Zinc	2.0
Titanium	0.56
Cobalt	0.43
Strontium	0.47
Chromium	0.60
Barium	ND
Phosphorus	ND
Silver	ND

ND = not detected

(continued)

INDUSTRIAL BOILER DESIGN DATA

Location No. 17 Test No. 7 Unit No. F-8

Unit Description CE Packaged Boiler
3,200 SCFM - 12 in

Installation Date	1967
Steam Output (10^3 lb/hr)	110
Design Pressure (psig)	190
Final Steam Temp (°F)	380
Furnace Type	Watertube
Furnace Size L-W-H (ft)	30 - 17 - 11.5
Furnace Area (ft^2)	1165
Furnace Volume (ft^3)	1950
Burner Description	8 Peabody Steam Atomized Burners 8 Ring Burners for Gas Fuel
Horiz. Burner Spacing (ft)	0
Vert. Burner Spacing (ft)	4
Test Fuel	#2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	~ 320
Stack Temp (°F) Before Air Heater	~ 540

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load ($\times 10^3$ lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
CO_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F) [illegible]							
Fuel Flow [illegible]							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at % O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BUTLER EMISSION MEASURMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]					
Test Type	[illegible]	[illegible]					
Test Load (10^3 lb/hr)	[illegible]	[illegible]					
Excess O_2 (%)	[illegible]	[illegible]					
NO_x (ppm)*	[illegible]	[illegible]					
NO (ppm)*	[illegible]	[illegible]					
CO_2 dry (%)	[illegible]	[illegible]					
CO (ppm)*	[illegible]	[illegible]					
HC (ppm)*	[illegible]	[illegible]					
SO_x (ppm)*	[illegible]	[illegible]					
SO_2 (ppm)*	[illegible]	[illegible]					
Total Part. (lb/MBtu)	[illegible]	[illegible]					
Solid Part. (lb/MBtu)	[illegible]	[illegible]					
Boiler Efficiency (%)	[illegible]	[illegible]					
Smoke Spot No.	[illegible]	[illegible]					
Opacity (%)	[illegible]	[illegible]					
Final Stm Pres. (psig)	[illegible]	[illegible]					
Final Stm Temp. (°F)	[illegible]	[illegible]					
Combus. Air Temp. (°F)	[illegible]	[illegible]					
Stack Temp. (°F)	[illegible]	[illegible]					
Fuel Flow [illegible]	[illegible]	[illegible]					
Fuel Temp. (°F)	[illegible]	[illegible]					
Fuel Pres. (psig)	[illegible]	[illegible]					
Furnace Pres. (in. H_2O)	[illegible]	[illegible]					
Register (% open)	[illegible]	[illegible]					

*at 3% O_2 dry

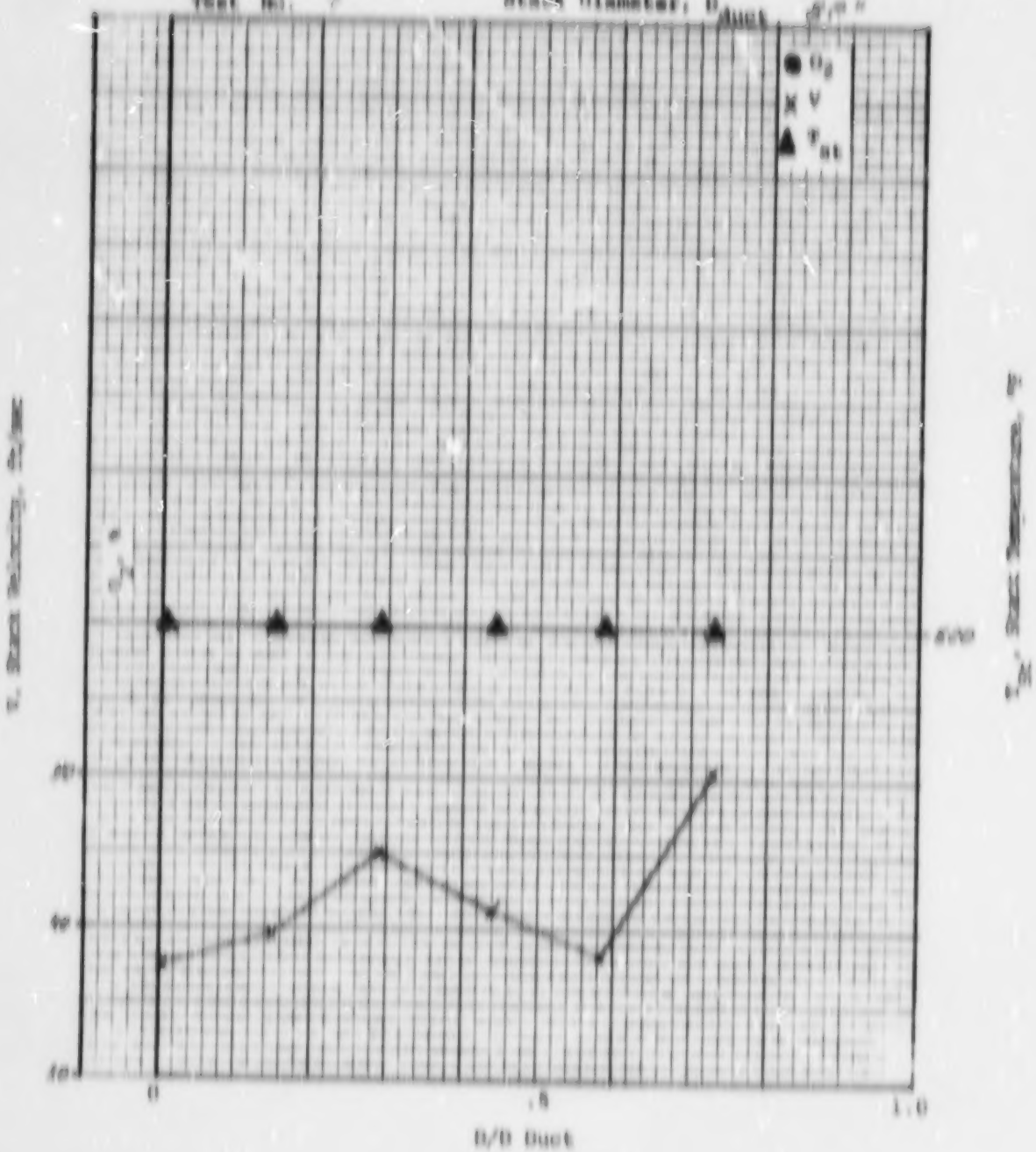
Emissions for Industrial Boilers as a Function of Excess Oxygen

STACK TRAVERS DATA

Location No. [illegible] Fuel [illegible]

Unit No. [illegible] Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D Duct [illegible]



K V B ENGINEERING, INC.
17988 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 838-8881

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cate

DATE: 7/30/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 6/26/74

KVB CHARGE NO.: 6000

ANALYZED: 7/18/74

INVESTIGATION: Spectrographic Analysis
Supplement to Lab No. 741190

LABORATORY NO: 741190

Sample Identification:

No. 8 Test 7; April 29, 1974.

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

location 17
Unit T-8
Test 7

KVB

	No. 2
Carbon, %	87.33
Hydrogen, %	12.31
Ash, %	0.004
Carbon Residue, %	0.031
Flash Point, °C	53
Aniline Point, °C	51.6
Heat of Combustion:	
Gross, Btu/lb.	19,340
Net, But/lb.	18,220
API Gravity	33.2 at 70°F
Nitrogen, %	.01
Sulfur, %	.18
Oxygen, %	.28
Viscosity at 40°C, SSU	34.2

Respectfully Submitted,

Dr. J. George Sotter
Laboratory Director

location 1?
sheet 1 of
lead ?

	Parts Per Million As Oil No. 3
Vanadium	0.15
Nickel	0.18
Iron	25.
Tin	0.015
Magnesium	0.076
Silicon	1.4
Manganese	0.30
Lead	0.14
Aluminum	0.039
Calcium	0.060
Molybdenum	ND
Copper	0.056
Sodium	ND
Zinc	ND
Titanium	0.034
Cobalt	ND
Strontium	ND
Chromium	0.048
Barium	ND
Phosphorus	ND
Silver	ND

ND = not detected

(continued)

INDUSTRIAL BOILER DESIGN DATA

Location No. 10 Test No. 9 Unit No. 2

Unit Description Oil Boiler

Installation Date	1950
Steam Output (10^3 lb/hr)	90
Design Pressure (psig)	350
Final Steam Temp (°F)	450
Furnace Type	Watertube
Furnace Size L-W-H (ft)	19 - 11 - 19
Furnace Area (ft^2)	1030
Furnace Volume (ft^3)	4200
Burner Description	3 @ 4 W Steam Atomized Burners
Horiz. Burner Spacing (ft)	3'-1"
Vert. Burner Spacing (ft)	3'
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	~ 200
Primary Air Temp (°F)	≈ Ambient
Stack Temp (°F)	~ 700

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
O_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]				
Test Type	[illegible]	[illegible]	[illegible]				
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]				
Excess O_2 (%)	[illegible]	[illegible]	[illegible]				
NO_x (ppm)*	[illegible]	[illegible]	[illegible]				
NO (ppm)*	[illegible]	[illegible]	[illegible]				
CO_2 dry (%)	[illegible]	[illegible]	[illegible]				
CO (ppm)*	[illegible]	[illegible]	[illegible]				
HC (ppm)*	[illegible]	[illegible]	[illegible]				
SO_x (ppm)*	[illegible]	[illegible]	[illegible]				
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]				
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]				
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]				
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]				
Smoke Spot No.	[illegible]	[illegible]	[illegible]				
Opacity (%)	[illegible]	[illegible]	[illegible]				
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]				
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]				
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]				
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]				
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]				
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]				
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]				
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]				
Register (% open)	[illegible]	[illegible]	[illegible]				

*at 3% O_2 dry

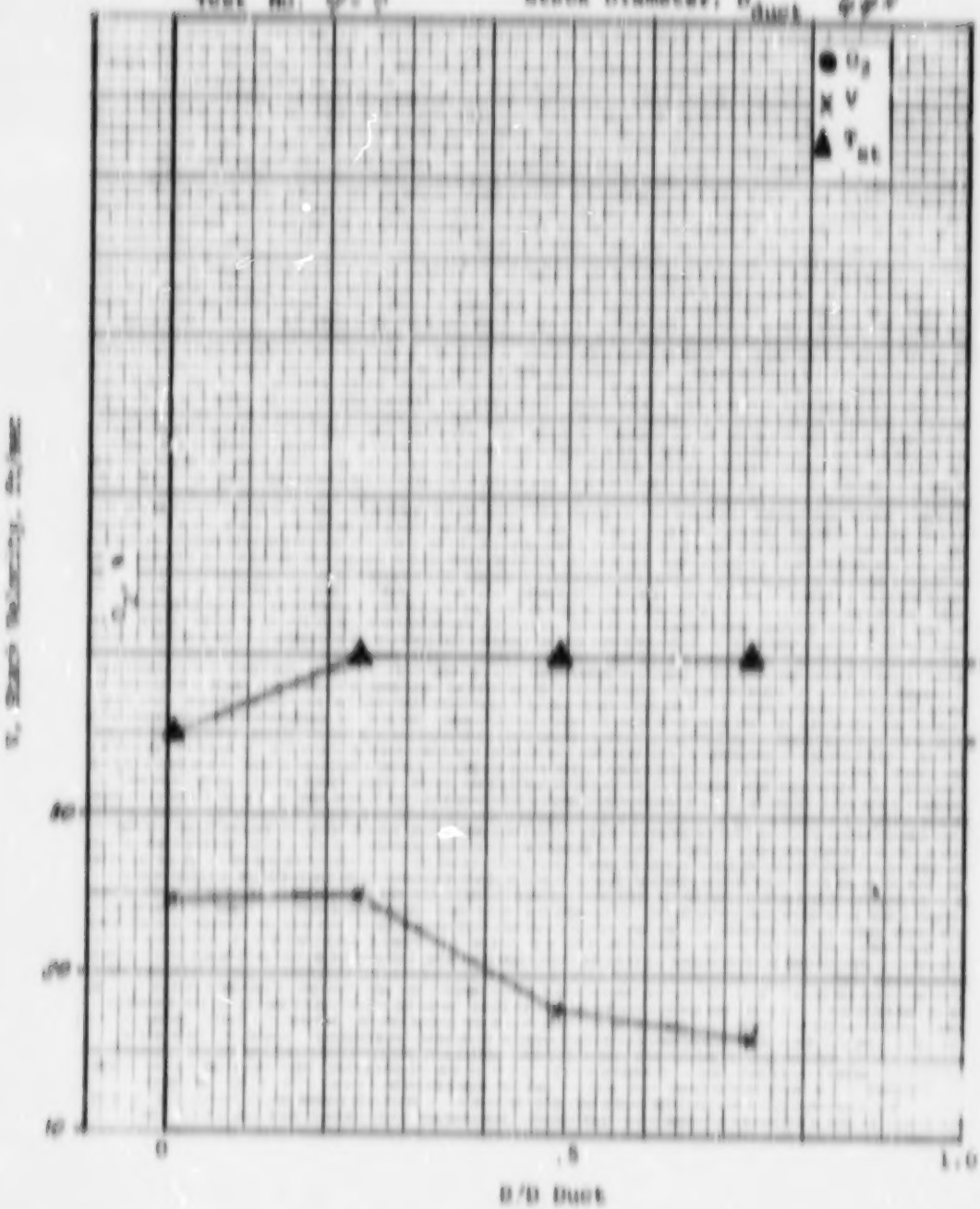
Reductions for Industrial Boilers as a Function of Excess Oxygen

STACK TRAVERSE DATA

Location No. 1B
Unit No 2
Test No. 4-1

Fuel #6 Oil
Load 78 MW(e)
Stack Diameter, D_{duct} 44'

lb/hr



K V B ENGINEERING, INC.
17988 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 838-8000

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cata

DATE: 9/23/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 8/26/74

KVB CHARGE NO.: 6000

ANALYZED: 9/18/74

INVESTIGATION: Spectrographic Analysis
Supplement to Lab No. 741190

LABORATORY NO: 741190

Location 18
Unit 2
Test 9

Sample Identification:

No. 4 Test 9-B;
May 9, 1974.

, Boiler No. 2,

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

KVB

	No. 4
Carbon, %	86.34
Hydrogen, %	12.18
Ash, %	0.031
Carbon Residue, %	5.89
Flash Point, °C	129
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb.	18,420
Net, But/lb.	17,310
API Gravity	@ 70°F 21.8 at 70°F
Nitrogen, %	.26
Sulfur, %	1.04
Oxygen, %	.15
Viscosity at 40°C, SSU	198

* Sample Oil too dark to determine Aniline Point

** To be turned in at a later date

Respectfully Submitted,

Kenneth W. Crockett

for J. George Sotter
Laboratory Director

location 18
Unit 2
Test 9

KVB

Parts Per Million in Oil

	No. 4
Vanadium	90.
Nickel	16.
Iron	8.4
Tin	4.6
Magnesium	13.
Silicon	13.
Manganese	0.53
Lead	8.0
Aluminum	3.1
Calcium	13.
Molybdenum	0.099
Copper	0.13
Sodium	15.
Zinc	1.3
Titanium	0.24
Cobalt	0.22
Strontium	0.43
Chromium	0.84
Barium	ND
Phosphorus	trace
Silver	0.002

ND = not detected

(continued)

INDUSTRIAL BOILER DESIGN DATA

Location No: 18 Test No: 21 Unit No: 9

Unit Description 11 MW Boiler

Installation Date	1966
Steam Output (10^3 lb/hr)	105
Design Pressure (psig)	350
Final Steam Temp (°F)	930
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	15-12-27
Furnace Area (ft^2)	1760
Furnace Volume (ft^3)	8420
Burner Description	4 MW steam Atomized Burners
Horiz. Burner Spacing (ft)	3.83
Vert. Burner Spacing (ft)	4
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	240
Primary Air Temp (°F)	Amb
Stack Temp (°F)	485

Comments:

Burner Numbers

②	③
①	④

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 3

Fuel #6 O.F.

Test No.	21-1	21-2	21-3	21-4	21-5	21-6	21-7
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	80	57	46	37	99	80	80
Excess O_2 (%)	7.6	7.0	7.7	8.7	5.0	6.5	5.3
NO_x (ppm)*	391	435	200	335	215	253	300
NO (ppm)*	387	234	219	232	251	249	295
O_2 dry (%)	10.8	11.8	10.5	9.7	12.0	11.2	11.0
CO (ppm)*	0	0	0	0	108	0	270
HC (ppm)*							
SO_x (ppm)*	505						
SO_2 (ppm)*	488						
Total Part. (lb/MBtu)						0.0041	
Solid Part. (lb/MBtu)						0.0001	
Boiler Efficiency (%)				85	84	83	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	821	820	820	814	820	825	824
Final Stm Temp. (°F)	430	430	430	430	430	430	430
Combus. Air Temp. (°F)	420	390	370	350	435	410	410
Stack Temp. (°F)	445	385	350	330	415	435	420
Fuel Flow lb/Hr	5850	3750	2750	2700	7050	5850	5850
Fuel Temp. (°F)	210	204	206	209	210	212	214
Fuel Pres. (psig)	74	65	58	60	80	82	82
Furnace Pres. (in. H_2O)	-0.2	-0.2	-0.2	-0.2	-0.2	-0.18	-0.18
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 3

Fuel #6 Oil

Test No.	21-8	21-9	21-10	21-11	21-12	21-13	21-14
Test Type	Low Air	Hi Air	Low NOx	#5 Blower	#3 Blower	#5 Blower	#5 Blower
Test load (10^3 lb/hr)	79.5	80	78	79.5	76	76	76
Excess O_2 (%)	6.1	7.6	6.3	6.2	6.0	6.0	6.2
NO_x (ppm)*	329	314	230	240	330	320	329
NO (ppm)*	236	310	234	241	236	215	224
CO_2 dry (%)	11.3	10.4	11.6	11.4	11.4	11.6	11.6
CO (ppm)*	0	0	0	0	0	0	0
HC (ppm)*							
NO_x (ppm)*							
NO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	86						
Smoke Spot No							
Opacity (%)							
Final Stm Pres. (psig)	312	316	318	318	318	318	317
Final Stm Temp. (°F)	430	430	430	430	430	430	430
Combus. Air Temp. (°F)	415	418	420	415	415	410	410
Stack Temp. (°F)	435	430	440	430	435	430	430
Fuel Flow lb/hr	5 7600	5 7600	5 5500	5 5500	5 4900	5 5725	5 4975
Fuel Temp. (°F)	202	199	200	212	199	200	
Fuel Pres. (psig)	80	82	80	105	105	105	105
Furnace Pres. (in. H_2O)	-0.16	-0.18	-0.16	-0.16	-0.2	-0.18	-0.18
Register (% open)	100	100	[illegible]	[illegible]	[illegible]	[illegible]	

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 18

Unit 8

Fuel #6 0.1

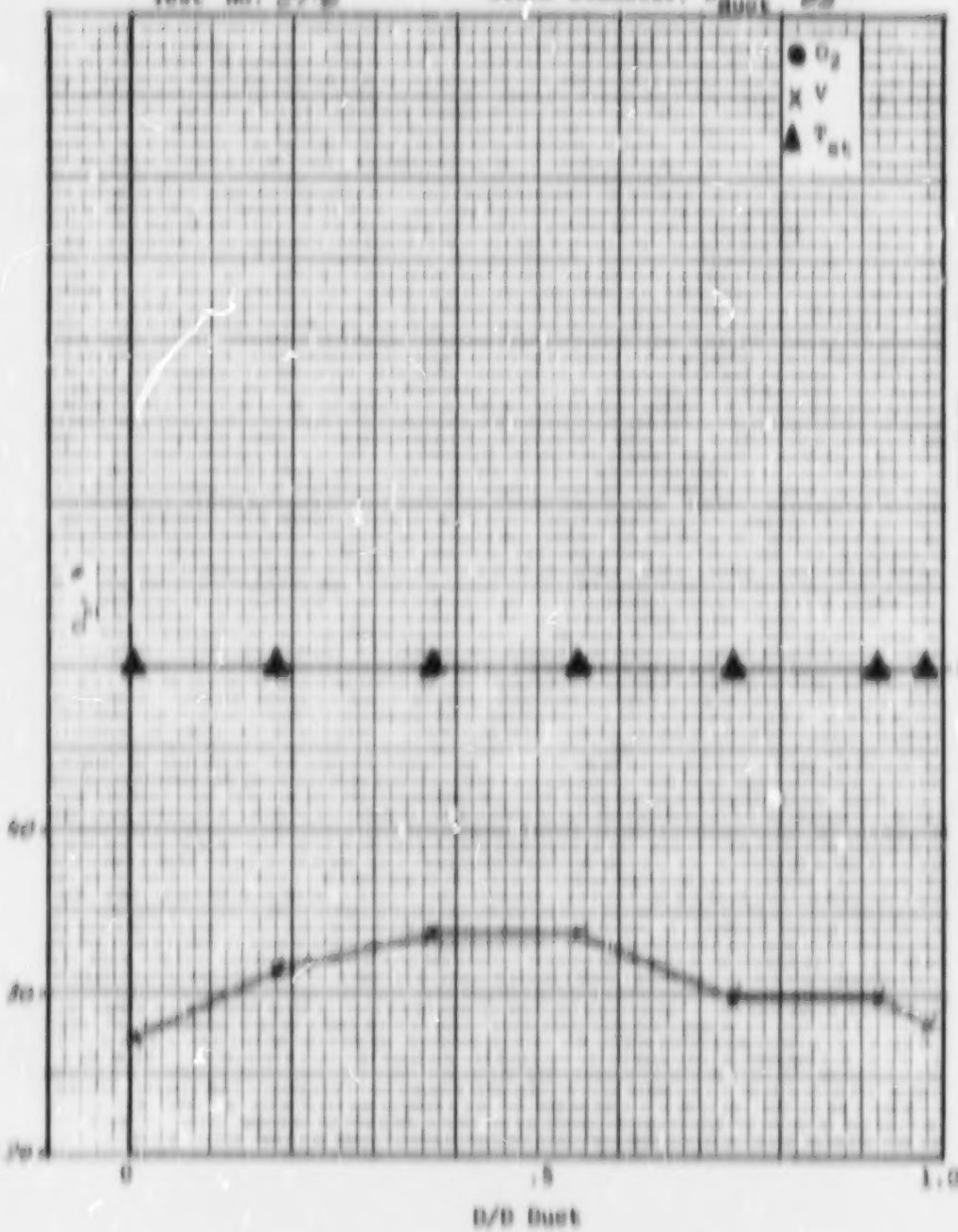
Test No.	21-15	21-16	21-17	21-18	21-19	21-20	
Test Type	99 Boxes	99 Boxes	99 Boxes	99 Boxes	99 Boxes	99 Boxes	
Test Load (10^3 lb/hr)	75	76	61	47	30	76	
Excess O_2 (%)	6.3	6.0	6.5	7.0	8.8	6.6	
NO_x (ppm)*	221	217	174	172	212	226	
NO (ppm)*	220	216	170	169	207	221	
CO_2 dry (%)	11.5	11.2	11.0	10.4	11.8	11.0	
CO (ppm)*	0	0	0	0	0	0	
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)						0.106	
Solid Part. (lb/MBtu)						0.0101	
Boiler Efficiency (%)						84	
Smoke Spot No.							
Opacity (%)							
Final Stm Press. (psig)	825	820	815	815	812	820	
Final Stm Temp. (°F)	915	930	930	930	930	930	
Combus. Air Temp. (°F)	410	410	370	370	360	405	
Stack Temp. (°F)	430	425	390	360	340	422	
Fuel Flow #/hr	5430	5400	4275	3300	2475	5400	
Fuel Temp. (°F)	190	188	185	190	200	190	
Fuel Press. (psig)	80	125	80	70	60	80	
Furnace Pres. (in H_2O)	-0.17	-0.18	-0.18	-0.16	-0.18	-0.18	
Register (% open)	100 100 100 0	80 80 100 30	60 60 100 30	50 50 100 30	50 50 100 30	80 80 100 30	

*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. /B
Unit No. 3
Test No. 21/6

Fuel #6 21:1
Load 800 000 lb/hr
Stack Diameter, D_{Duct} 60"



K V B ENGINEERING, INC.
[illegible] IRVINE BLVD.
TUSTIN, CALIFORNIA [illegible]
(714) [illegible]

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 7/22/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 6/13/74

KVB CHARGE NO.: 6000

ANALYZED: 7/18/74

INVESTIGATION: Spectrographic Analysis
Supplement to Lab No. 741190

LABORATORY NO: 741190

Location: [illegible]
Unit 3
Test 21

Sample Identification:

→ No. 3 Test 21: , Unit 3, May 2, 1974.

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

Location 18
Chart 2
Test 21

KVB

	No. 1
Carbon, %	86.72
Hydrogen, %	11.95
Ash, %	0.032
Carbon Residue, %	9.41
Flash Point, °C	129
Anilite Point, °C	*
Heat of Combustion:	
Gross, Btu/lb.	18,910
Net, But/lb.	17,820
API Gravity	32.9 at 70°F
Nitrogen, %	.26
Sulfur, %	1.03
Oxygen, %	1.01
Viscosity at 40°C, SSU	195

* Sample Oil too dark to determine Aniline Point
** To be turned in at a later date

Respectfully Submitted,
Arnold W. Cornell
for J. George Rotter
Laboratory Director

305

INDUSTRIAL BOILER DESIGN DATA

Location No. 18 Test No. 20 Unit No. 4

Unit Description Riley Boiler, Serial No. 3497

Installation Date	1965
Steam Output (10^3 lb/hr)	100
Design Pressure (psig)	320
Final Steam Temp (°F)	440
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	16 - 12 - 20
Furnace Area (ft^2)	1788
Furnace Volume (ft^3)	5100
Burner Description	4 Peabody steam flow burners
Horiz. Burner Spacing (ft)	5
Vert. burner Spacing (ft)	6.25
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	220
Primary Air Temp (°F)	550
Stack Temp (°F)	440

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location 18

Unit 6

Fuel #6 0.1

Test No.							
Test Type	Base	Low Excess Air	Low Excess Air	Low Coal	Low Excess Air	Low Excess Air	Low Excess Air
Test Load (10^3 lb/hr)	130	42	90	76	102	126	120
Excess O_2 (%)	6.8	2.8	5.1	6.2	2.1	2.1	2.2
NO_x (ppm)*	242	181	305	121	245	237	231
NO (ppm)*	235	219	304	118	242	235	228
O_2 dry (%)	11.0	10.2	10.1	9.6	10.9	10.4	10.0
CO (ppm)*	0	0	0	0	0	0	0
HC (ppm)*							
SO_x (ppm)*	948						
SO_2 (ppm)*	529						
Total Part. (lb/MMBtu)						0.0401	
Solid Part. (lb/MMBtu)						0.0385	
Boiler Efficiency (%)	86			86			
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	314	316	316	312	318	299	310
Final Stm Temp. (°F)	930	930	930	930	930	930	930
Combus. Air Temp. (°F)	548	528	528	490	530	531	534
Stack Temp. (°F)	405	370	385	385	390	410	405
Fuel Flow #/hr	7930	6740	8715	9480	7975	7800	7580
Fuel Temp. (°F)	204	190	188	203	204	200	202
Fuel Pres. (psig)	92	77	70	65	88	90	88
Furnace Pres. (in. H_2O)	-0.15	-0.2	-0.22	-0.18	-0.18	-0.16	-0.13
Register (% open)	70 90						

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location /8

Unit 4

Fuel #6 Oil

Test No.	08:08	08:09	08:10	08:11	08:12	08:13	08:14
Test Type	Low Air	Low Air	Hi Air	Hi Air	Air Varg.	Ø° Bias	Ø° Bias
Test Load (10^3 lb/hr)	120	120	120	118	120	118	110
Excess O_2 (%)	6.5	6.0	7.8	8.6	6.1	8.3	10.5
NO_x (ppm)*	336	333	267	270	336	168	115
NO (ppm)*	227	227	208	265	269	165	110
$(O)_2$ dry (%)	11.0	11.5	10.3	9.6	11.6	9.7	9.1
CO (ppm)*	0	96	0	0	0	355	67
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		86					
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	810	812	810	815	815	806	810
Final Stm Temp. (°F)	950	950	950	950	950	950	950
Combus. Air Temp. (°F)	542	542	542	540	580	585	590
Stack Temp. (°F)	404	403	403	411	410	400	390
Fuel Flow #1/#4	7280	7280	7345	7280	7280	7280	6611
Fuel Temp. (°F)	207	212	212	214	218	221	216
Fuel Pres. (psig)	90	90	90	91	91	109	90
Furnace Pres. (in. H_2O)	-0.1	-0.13	-0.10	-0.1	-0.2	-0.15	-0.15
Register (% open)	40 50 15 30	50 50 20 30	50 50 30 30	50 50 30 30	80 100 40 40	50 100 30 30	0 50 30 10

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location /8

Unit 4

Fuel #6 0.1

Test No.	5	6					
Test Type	Full Load	Full Load					
Test Load (10^3 lb/hr)	108	105					
Excess O_2 (%)	9.7	10.5					
NO_x (ppm)*	185	178					
NO (ppm)*	183	178					
CO_2 dry (%)	9.0	9.0					
CO (ppm)*	49	0					
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)		0.1969					
Solid Part. (lb/MBtu)		0.0488					
Boiler Efficiency (%)		88					
Smoke Spot No.							
Opacity (%)							
Final Stm Press. (psig)	1250	1250					
Final Stm Temp. (°F)	930	930					
Combus. Air Temp. (°F)	490	490					
Atmch Temp. (°F)	590	590					
Fuel Flow /1/44	6695	6695					
Fuel Temp. (°F)	190	220					
Fuel Pres. (psig)	80	80					
Furnace Pres. (in.H_2O)	-0.1	-0.2					
Register (% open)	100 30 80	90 100 60					

*at 3% O_2 dry

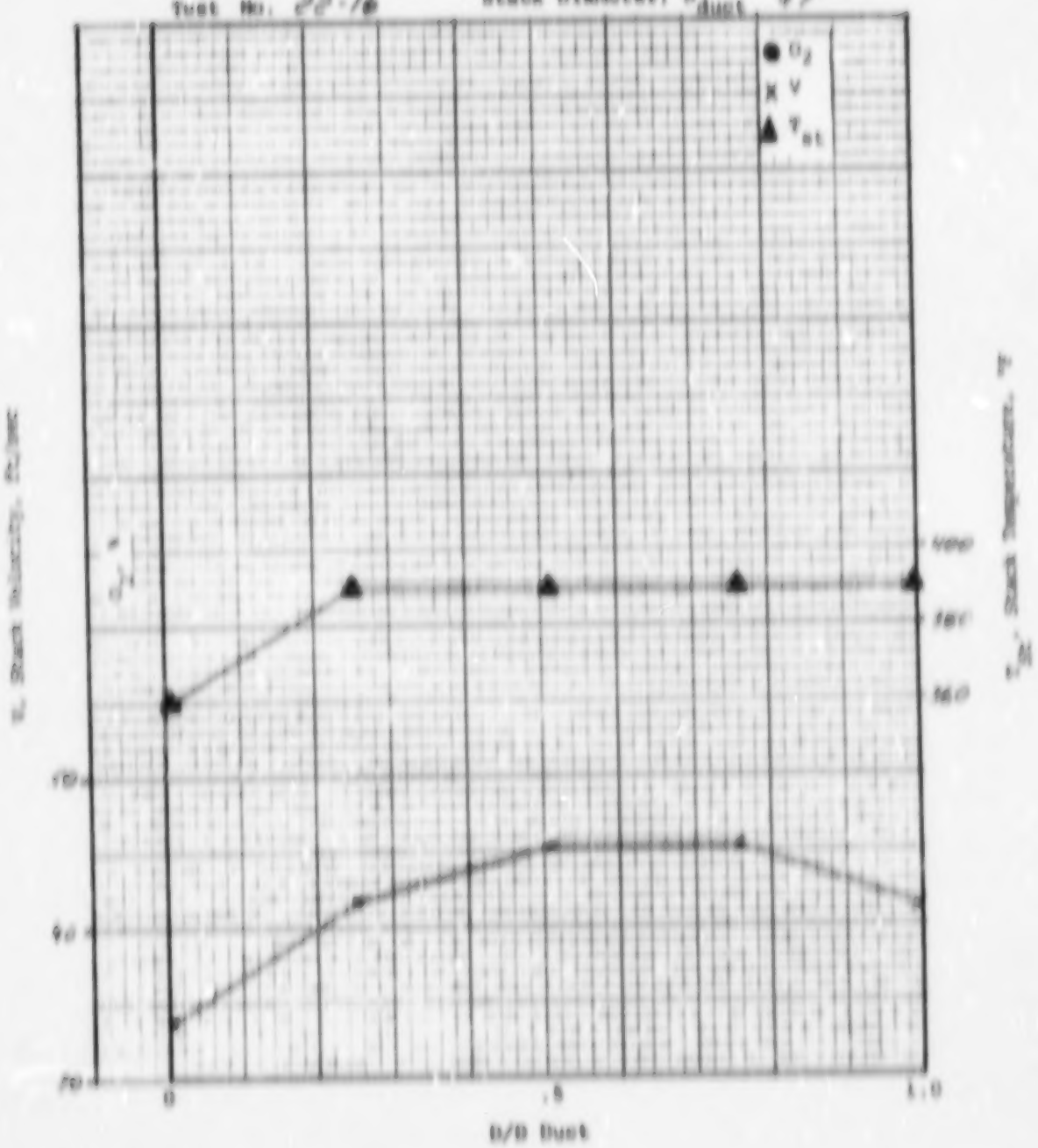
310

STACK TRAVERSE DATA

Location No. 18 Fuel # 6 Oil

Unit No. 4 Load 105,000 lb/hr

Test No. 22-16 Stack Diameter, D_{duct} 42"



K V B ENGINEERING, INC.
17332 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-9021

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 7/23/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 6/26/74

KVB CHARGE NO.: 6000

ANALYZED: 7/18/74

INVESTIGATION: Spectrographic Analysis
Supplement to Lab No. 741190

LABORATORY NO: 741190

location 10
Unit 4
Test 22

Sample Identification:

Test 22 No. 3 Test 21; , Unit 3, May 3, 1974.

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

KVB

Serafica 18
Unit 4
Test 22

	No. 1
Carbon, %	85.72
Hydrogen, %	11.94
Ash, %	0.032
Carbon Residue, %	5.41
Flash Point, °C	129
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb.	18,910
Net, Btu/lb.	17,820
API Gravity	22.9 at 70°F
Nitrogen, %	.26
Sulfur, %	1.03
Oxygen, %	1.01
Viscosity at 40°C, rcu	195

* Sample Oil too dark to determine Aniline Point
** To be turned in at a later date

Respectfully Submitted,
Arnold W. Einhorn, Inc.
Leo J. George Sutter
Laboratory Director

Formation 18
Chart 4
Test 22

	Parts Per Million in Oil No. 3
Vanadium	100.
Nickel	9.9
Iron	18.
Tin	1.8
Magnesium	11.
Silicon	8.0
Manganese	0.38
Lead	2.4
Aluminum	0.77
Calcium	10.
Molybdenum	0.077
Copper	0.17
Sodium	24.
Zinc	50
Titanium	0.15
Cobalt	0.096
Strontium	trace
Chromium	0.10
Barium	10
Phosphorus	10
Silver	10

10 = not detected

(continued)

INDUSTRIAL BOILER DESIGN DATA

Location No. 19 | Test No. 1 | Unit No. 1

Unit Description: Keeler Packaged Boiler Type D. Model WB-1-745

Installation Date	1970
Steam Output (10^3 lb/hr)	12.5
Design Pressure (psig)	250
Final Steam Temp (°F)	406
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9-6-8
Furnace Area (ft^2)	327
Furnace Volume (ft^3)	393
Burner Description	1 Faber steam Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	200
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	460

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location /@

Unit /

Fuel # 6 Oil

Test No.	1-1	1-2	1-3	1-4	2-1	2-2	2-3
Test Type	W. Air	Low Air	Low Air	Low Air	Nl Air	Normal Air	Normal Air
Test Load (10^3 lb/hr)	14.5	15	14.5	14.5	14.5	14.5	9.7
Excess O_2 (%)	4.4	3.3	1.6	2.7	3.0	3.5	6.4
NO_x (ppm)*	423	338	276	338	391	336	274
NO (ppm)*	417	332	271	333	385	331	268
CO_2 dry (%)	12.8	14.7	14.6	14.4	13.2	14.4	11.4
CO (ppm)*	0	48	233	0	0	12	0
HC (ppm)*							
SO_x (ppm)*							
F^- (ppm)*							
Total Part. (lb/MMBtu)							
Solid Part. (lb/MMBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	148	150	150	148	148	148	150
Final Stm Temp. (°F)	370	370	370	370	370	370	370
Combus. Air Temp. (°F)	Ambient						
Stack Temp. (°F)	400						
Fuel Flow (GPH)	2.0	2.17	2.0	2.12	2.1	2.0	1.4
Fuel Temp. (°F)	199	195	198	200	200	148	70
Fuel Pres. (psig)	78	77	79	80	75	78	114
Furnace Pres. (in H_2O)	0.5	0.5	0.52	0.9	0.5	0.4	0
Register (% open)	100	100	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

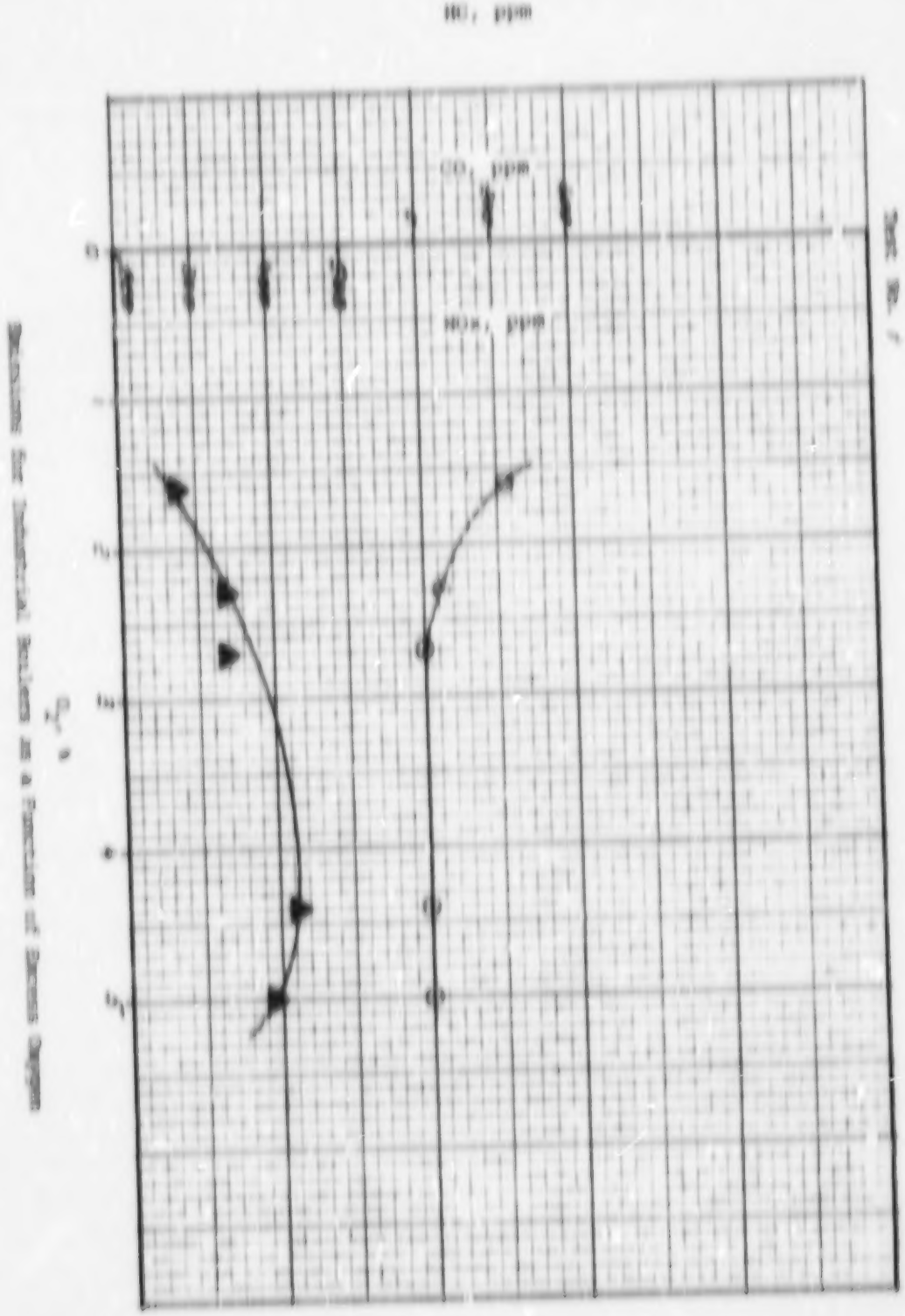
Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bacharach Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

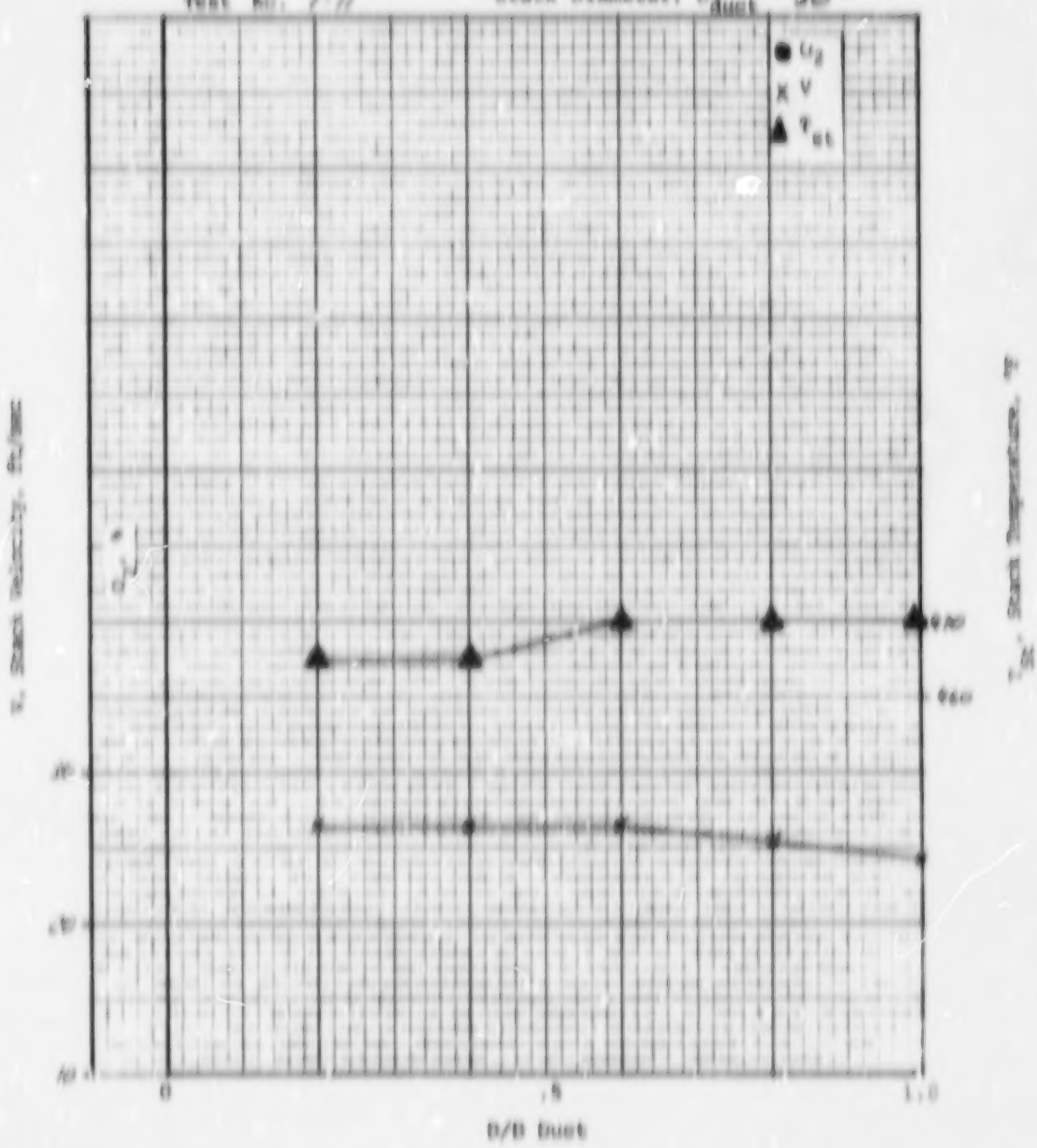

CO, ppm
NOx, ppm
Ringelmann Smoke No.

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. 1 Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D_{Duct} [illegible]"



INDUSTRIAL BOILER DESIGN DATA

Location No. 19 Test No. C-1 Unit No. 1

Unit Description Keeler Packaged Boiler Type D. Model WB-1-745

Installation Date	1970
Steam Output (10^3 lb/hr)	17.5
Design Pressure (psig)	250
Final Steam Temp (°F)	400
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9-6-8
Furnace Area (ft^2)	327
Furnace Volume (ft^3)	392
Burner Description	1 Faber Air Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	200
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	485

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL NOX DATA

Location [illegible]

Unit 1

Fuel #6 @ 0.1

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MMBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MMBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (GPM)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in.H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

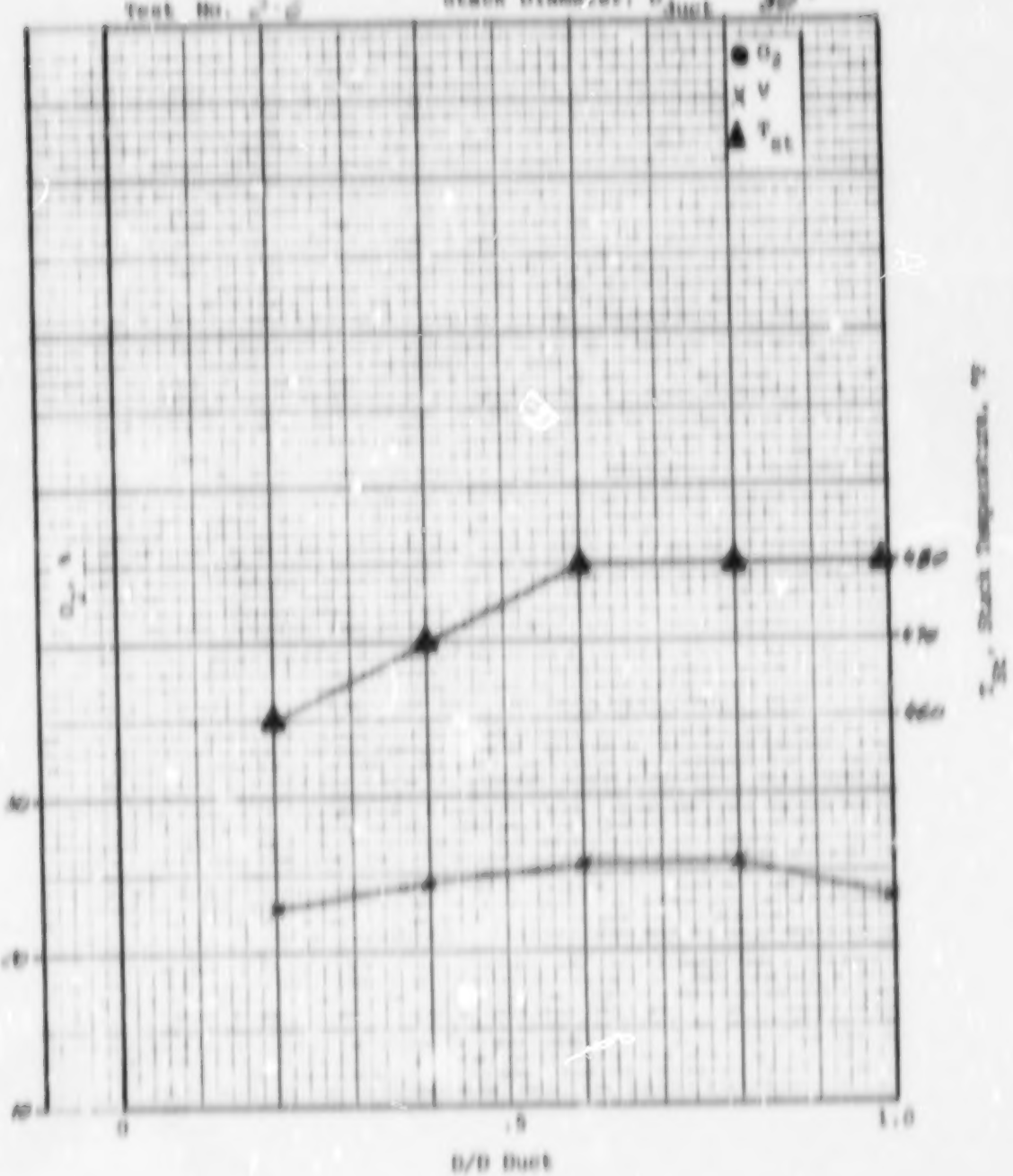
*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. 19 Fuel #6 Oil

Unit No. 1 Load 16,000 lb/hr

Test No. 2-6 Stack Diameter, D_{duct} 60"



K V B ENGINEERING, INC.
17300 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8020

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cate

DATE: 7/22/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 6/26/74

KVB CHARGE NO.: 6000

ANALYZED: 7/18/74

INVESTIGATION: Spectrographic Analysis
Supplement to Lab No. 741190

LABORATORY NO: 741190

Location 19
Unit 1
Test 1, 2

Sample Identification:

No. 5 Test 1-10; Upto 1, May 13, 1974.

U.L. FOLLOWING PAGE
FOR SAMPLE RESULTS

KVB

	No. 5
Carbon, %	86.06
Hydrogen, %	10.37
Ash, %	0.044
Carbon Residue, %	1.43
Flash Point, °C	154
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb.	18,280
Net, Btu/lb.	17,340
API Gravity	11.3 at 70°F
Nitrogen, %	.44
Sulfur, %	**
Oxygen, %	**
Viscosity at 40°C	668 (at 60°C)

* Sample Oil too dark to determine Aniline Point

** To be turned in at a later date

Respectfully Submitted,

Geo. J. George Rotter
Laboratory Director

KVB

locations: 19
11, 17 1
Test 4 d

	Parts Per Million As Oil	
	No. 5	No. 6
Vanadium	75.	*
Nickel	9.7	
Iron	8.3	
Tin	0.13	
Magnesium	3.2	
Silicon	79.	
Manganese	0.28	
Lead	1.2	
Aluminum	33.	
Calcium	1.4	
Molybdenum	0.018	
Copper	0.060	
Sodium	3.6	
Zinc	0.84	
Titanium	0.23	
Cobalt	0.092	
Strontium	ND	
Chromium	0.04	
Barium	ND	
Phosphorus	14.	
Silver	ND	

ND = not detected
*There was insufficient ash for a spectrographic analysis.

Respectfully submitted,

J. George Sotter

J. George Sotter
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 19 Test No. E2 Unit No. 1

Unit Description Keeler Packaged Boiler Type D
Model WD-1-165

Installation Date	1970
Steam Output (10^3 lb/hr)	165
Design Pressure (psig)	250
Final Steam Temp (°F)	406
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9·6·8
Furnace Area (ft^2)	327
Furnace Volume (ft^3)	393
Burner Description	1 Faber Steam Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	475

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL NOX DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
HC (ppm)*							
SO_x (ppm)*					[illegible]		
SO_2 (ppm)*					[illegible]		
Total Part. (lb/MBtu)					[illegible]		
Solid Part. (lb/MBtu)					[illegible]		
Boiler Efficiency (%)		[illegible]			[illegible]		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Combus. Air Temp. (°F)	[illegible]				[illegible]		
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Furnace Pres. (in.H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

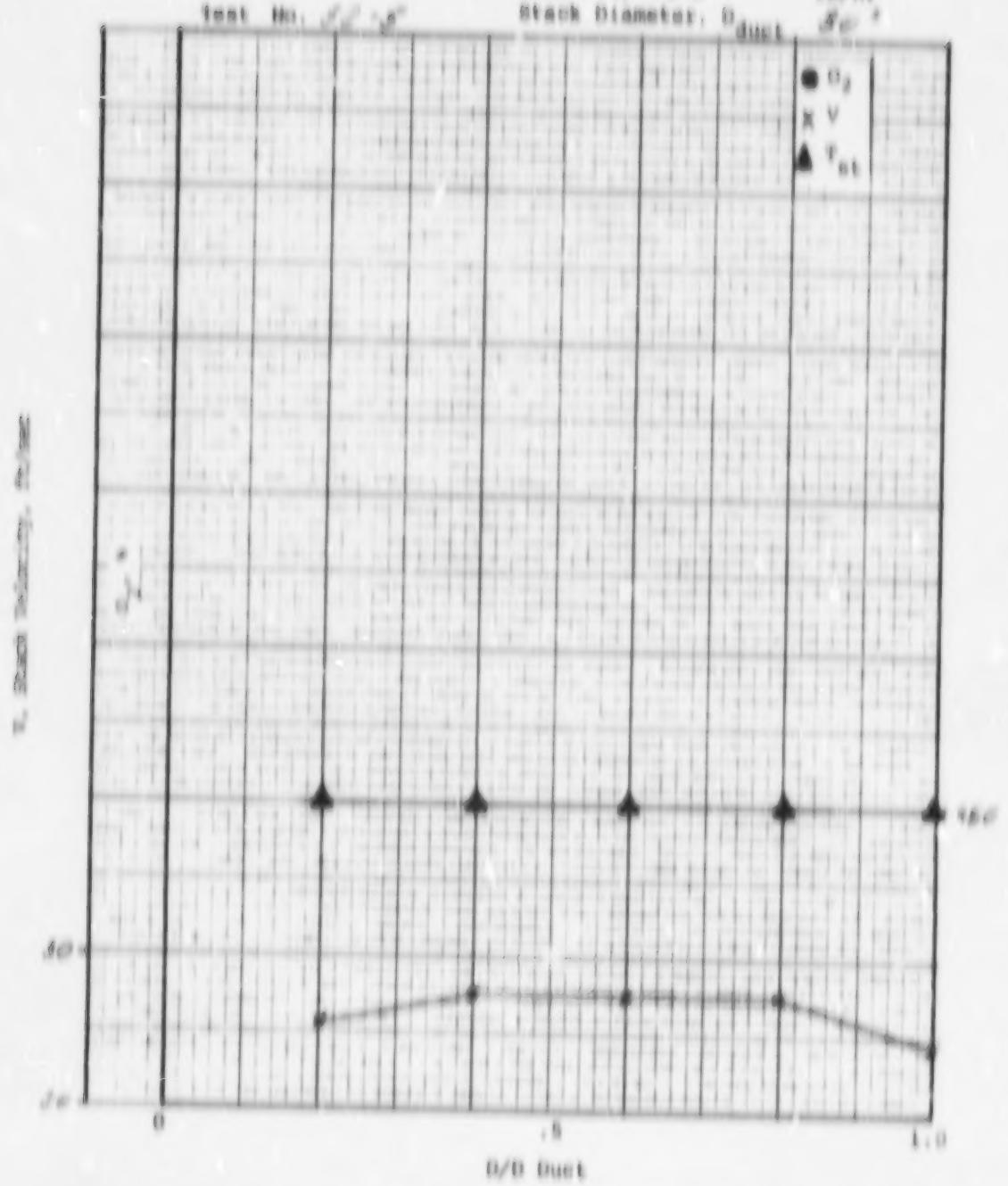
*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. [illegible]
Unit No. [illegible]
Test No. [illegible]

Fuel [illegible]
Load [illegible]
Stack Diameter, D_{duct} [illegible]

lb/hr



INDUSTRIAL BOILER DESIGN DATA

Location No. 19 Test No. 18 Unit No. 1

Unit Description Keeler Watertube Boiler Type D. Model WB-1-185

Installation Date	1950
Steam Output (10^3 lb/hr)	185
Design Pressure (psig)	250
Final Steam Temp (°F)	400
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9-6-8
Furnace Area (ft^2)	867
Furnace Volume (ft^3)	392
Burner Description	1 Foster Air Atomizing Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	480

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit

Fuel [illegible]

Test no.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test type	[illegible]						
Test load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
SO_x (ppm)[a]						[illegible]	
SO_2 (ppm)[a]						[illegible]	
Total Part. (lb/MBtu)						[illegible]	
Solid Part. (lb/MBtu)						[illegible]	
Boiler Efficiency (%)	[illegible]	[illegible]				[illegible]	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Flow (gal/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

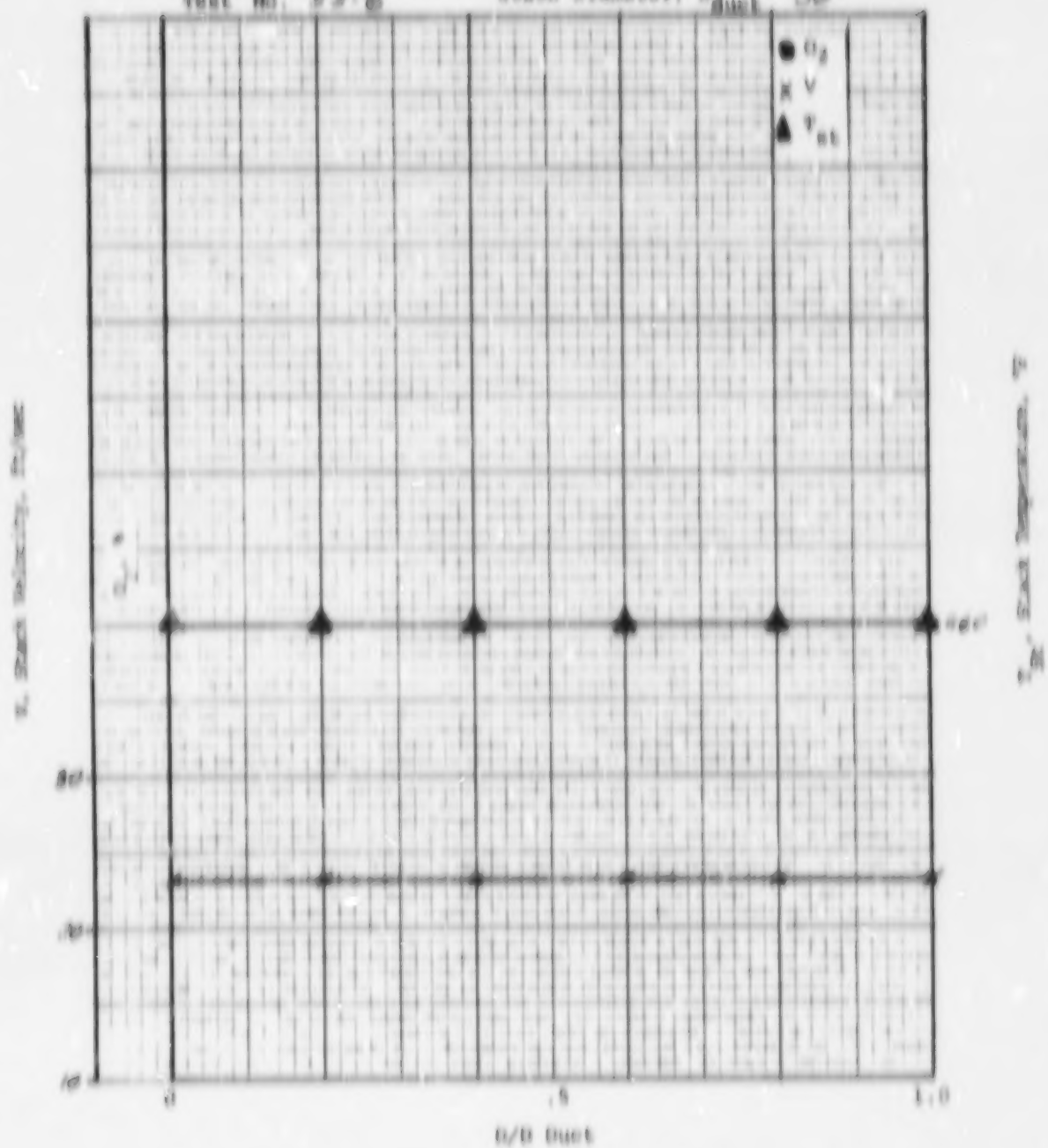
[a] at 3% O_2 dry

STACK TRAVERSE DATA

Location No. 19 Fuel #2 Oil

Unit No. 1 Load 15,000 lb/hr

Test No. 5-1-85 Stack Diameter, D_{duct} 72"



INDUSTRIAL BOILER DESIGN D.TA

Location No. 17 Test No. 59 Unit No. 1

Unit Description Keeler Packaged Boiler Type D
Model WB-1-125

Installation Date	1950
Steam Output (10^3 lb/hr)	125
Design Pressure (psig)	200
Final Steam Temp (°F)	400
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9-6-8
Furnace Area (ft^2)	327
Furnace Volume (ft^3)	392
Burner Description	1 Foster Mechanical Atom. Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	490

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL IDEM DATA

Location 19

Unit 1

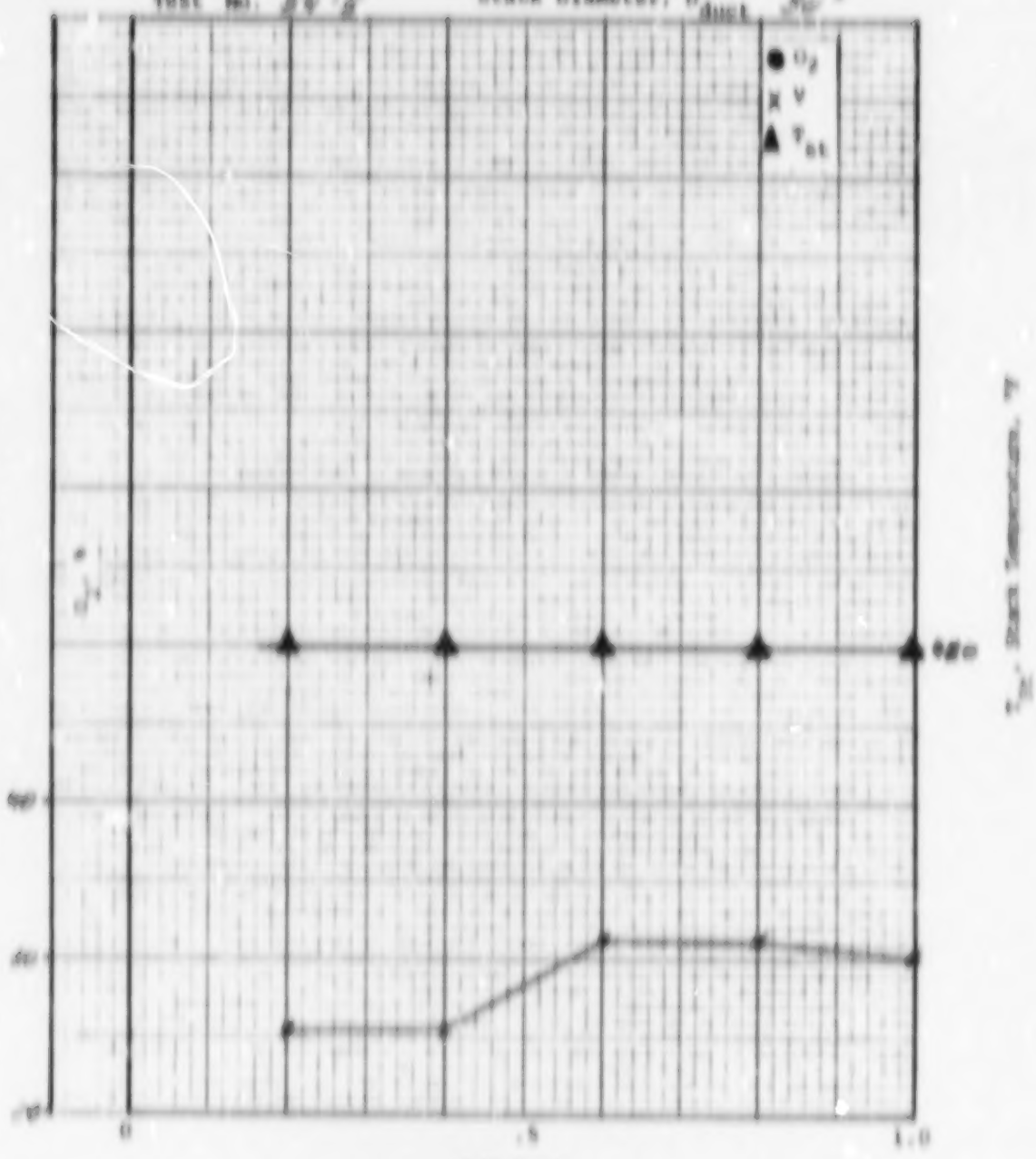
Fuel #2 0.1

Test No.							
Test Type							
Test load (10^3 lb/h.)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
CO_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_2 (ppm)*							
SO_3 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (gph)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. 19 Fuel [illegible]
Unit No. 1 Load [illegible] lb/hr
Test No. [illegible] Stack Diameter, D_{duct} [illegible]



KVB ENGINEERING, INC.
17300 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-2661

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cate

DATE: 7/23/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 6/26/74

KVB CHARGE NO.: 6000

ANALYZED: 7/18/74

INVESTIGATION: Spectrographic Analysis
Supplement to Lab No. 741190

LABORATORY NO: 741190

Sample Identification:

No. 6 Test 12-2; Unit 1, May 16, 1974.

	No. 5
Carbon, %	87.38
Hydrogen, %	12.64
Ash, %	0.001
Carbon Residue, %	0.05
Flash Point, °C	88
Aniline Point, °C	58.6
Heat of Combustion:	
Gross, Btu/lb.	19,470
Net, Btu/lb.	18,360
API Gravity	34.8 at 70°
Nitrogen, %	.006
Sulfur, %	.06
Oxygen, %	.12
Viscosity at 40°C	11.0

Respectfully Submitted,

Geo. J. George Sutter
Laboratory Director

340

KVB

Locations 19
Years 1
Test 52, 53, 54

Parts Per Million in Oil
No. 5

Vanadium	0
Nickel	
Iron	
Tin	
Magnesium	
Silicon	
Manganese	
Lead	
Aluminum	
Calcium	
Molybdenum	
Copper	
Sodium	
Zinc	
Titanium	
Cobalt	
Strontium	
Chromium	
Boron	
Phosphorus	
Silver	

ND = not detected
*There was insufficient ash for a spectrographic analysis.

Respectfully submitted,

J. George Sotter

J. George Sotter
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 19 Test No. 79-WB Unit No. 2

Unit Description Keeler Boiler Type D, Model WB-1-185

Installation Date	1950
Steam Output (10^3 lb/hr)	125
Design Pressure (psig)	250
Final Steam Temp (°F)	410
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9 · 6 · 8
Furnace Area (ft^2)	327
Furnace Volume (ft^3)	392
Burner Description	Timber air & steam atom. burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 oil
Fuel Temp at Burner (°F)	200
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	490

Comments: Boiler was equipped with overfire air ports and flue gas recirculation ducting.

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location /9

Unit 4

Fuel # 6 Oil

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
CO_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Press. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Press. (psig)							
Furnace Press. (in. H_2O)							
Registers (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(X)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]				
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)					[illegible]		
Smoke Spot No.	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]						[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL RKIN DATA

Location /9

Unit 7

Fuel #6 Oil

Test No.	197:1	197:2	197:3	197:4	197:5	197:6	197:7
Test Type	Fdh R	Fdh R	Fdh R	Fdh R	Fdh R	Fdh R	Fdh R
Test Load (10^3 lb/hr)	14	14.7	14.2	14	13.88	14.1	14.2
Excess O_2 (%)	4.5	4.7	5.0	5.1	4.9	4.8	5.1
NO_x (ppm)*	187	182	188	182	198	182	198
NO (ppm)*	187	180	183	182	198	180	198
O_2 dry (%)	12	12.86	12.8	13.0	12.8	14	12.8
CO (ppm)*	0	N.A	0	0	0	32	0
HC (ppm)*	8	12	0	0	0	0	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)				83	84		
Smoke Spot No.		4	4.5	4	4.5	4	4
Opacity (%)		5	5	5	5	5	5
Final Stm Pres. (psig)	151	150	150	150	150	150	150
Final Stm Temp. (°F)	Saturat						
Combus. Air Temp. (°F)	100	99	98	114	115	121	122
Stack Temp. (°F)	488	499	504	483	487	490	499
Fuel Flow (GPM)	2.02	2.02	2.3	2.3	2.3	2.25	2.25
Fuel Temp. (°F)	230	190	198	200	200	205	209
Fuel Pres. (psig)	99	99	99	93	93	99	99
Furnace Pres. (in H_2O)	0.0	0.5	0.54	0.5	0.5	0.0	0.0
Registes (% open)	80	80	80	80	80	80	80

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location

Unit

Fuel

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
$(O)_2$ dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL HOOK DATA

Location /0

Unit 3

Fuel #6 Oil

Test No.	10:7	10:8	10:9	10:10	10:11	10:12	10:1
Test Type	5 of 4	5 of 4	5 of 4	5 of 4	5 of 4	5 of 4	5 of 4
Test Load (10^3 lb/hr)	13.2	13.6	14	14	14	14.2	13.9
Excess O_2 (%)	2.0	2.3	2.7	2.9	3.3	3.1	2.6
NO_x (ppm)*	190	182	109	120	128	133	190
NO (ppm)*	180	182	107	114	122	132	190
CO_2 dry (%)	13.2	13	12.8	12.8	12.6	12.8	13.2
CO (ppm)*	6.8	0	301	990	431	0	0
HC (ppm)*	0	0	57	162	89	16	8
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)						0.027	
Solid Part. (lb/MBtu)						0.024	
Boiler Efficiency (%)		83				82	
Smoke Spot No.	2.0	3	2	4	2.5	4	2
Opacity (%)				20	15	8	2
Final Stm Pres. (psig)	150	149	154	150	151	151	152
Final Stm Temp. (°F)	366						
Combus. Air Temp. (°F)	92	93	97	97	100	99	101
Stack Temp. (°F)	340	339	336	340	339	336	340
Fuel Flow gpm	2.1	2.1	2.26	2.3	2.3	2.3	2.2
Fuel Temp. (°F)	230	230	230	230	230	230	99
Fuel Pres. (psig)	95	95	95	99	99	95	98
Furnace Pres. (in. H_2O)	0.20	0.2	0.2	0.20	0.2	0.20	0.18
Register (% open)	60	60	60	60	60	60	60

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL RUN DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			[illegible]	[illegible]			
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]						
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Registers (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL RECORD DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Base	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*						[illegible]	
SO_2 (ppm)*						[illegible]	
Total Part. (lb/MBtu)						[illegible]	
Solid Part. (lb/MBtu)						[illegible]	
Boiler Efficiency (%)						[illegible]	
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]		[illegible]	[illegible]	[illegible]		
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]						
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

MID CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL RAM DATA

Location /9

Unit #

Fuel #6 oil

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO$_x$ (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO$_x$ (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO$_2$ (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]						
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL NOM DATA

Location 19

Unit 17

Fuel #6 Oil

Test No.							
Test Type	FOR						
Test Load (10^3 lb/hr)	14	14	14	18.2	18.2	18.2	18.2
Excess O_2 (%)	1.9	2	2.3	2.2	3.1	3.0	3.0
NO_x (ppm)*	120	110	120	122	103	191	199
NO (ppm)*	105	130	117	119	103	191	199
CO_2 dry (%)	13.9	13.9	13.9	13.2	13.6	13.6	13.6
CO (ppm)*	0	36	192	103	19	60	84
HC (ppm)*	0	10	101	58	20	69	71
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							83
Smoke Spot No.	0.5	7	9	9	15	7	9
Opacity (%)	5	6	20	20	15	10	20
Final Stm Pres. (psig)	152	153	159	152	151	152	159
Final Stm Temp. (°F)	Saturat.						
Combus. Air Temp. (°F)	107	105	105	105	106	85	108
Stack Temp. (°F)	521	512	509	510	520	508	522
Fuel Flow (GPH)	2.0	2.3	2.3	2.6	2.8	2.1	2.1
Fuel Temp. (°F)	302	303	305	304	304	299	306
Fuel Pres. (psig)	50	50	50	50	50	50	50
Furnace Pres. (in. H_2O)	0.02	0.1	0.15	0.25	0.1	0.05	0.15
Register (% open)	80	60	60	60	60	60	60

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location /9

Unit 8

Fuel #6 oil

Test No.	8B-7						
Test Type	DCA						
Test Load (10^3 lb/hr)	14						
Excess O_2 (%)	2.9						
NO_x (ppm)*	181						
NO (ppm)*	181						
$(R)_2$ dry (%)	12.86						
CO (ppm)*	30						
HC (ppm)*	0						
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)	0.047						
Solid Part. (lb/MBtu)	0.042						
Boiler Efficiency (%)	88						
Smoke Spot No.	8						
Opacity (%)	5						
Final Stm Pres. (psig)	1270						
Final Stm Temp. (°F)	Saturated						
Combus. Air Temp. (°F)	103						
Stack Temp. (°F)	310						
Fuel Flow gpm	2.12						
Fuel Temp. (°F)	250						
Fuel Pres. (psig)	82.5						
Furnace Pres. (in. H_2O)	0.06						
Register (% open)	66						

*at 3% O_2 dry

EXHAUST EMISSION MEASUREMENTS

AND CONTROL NOX DATA

Location: [illegible]

Unit: [illegible]

Fuel Sulfur: [illegible] % @ [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(O)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F) @ [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig) @ [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)[b]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL TECH DATA

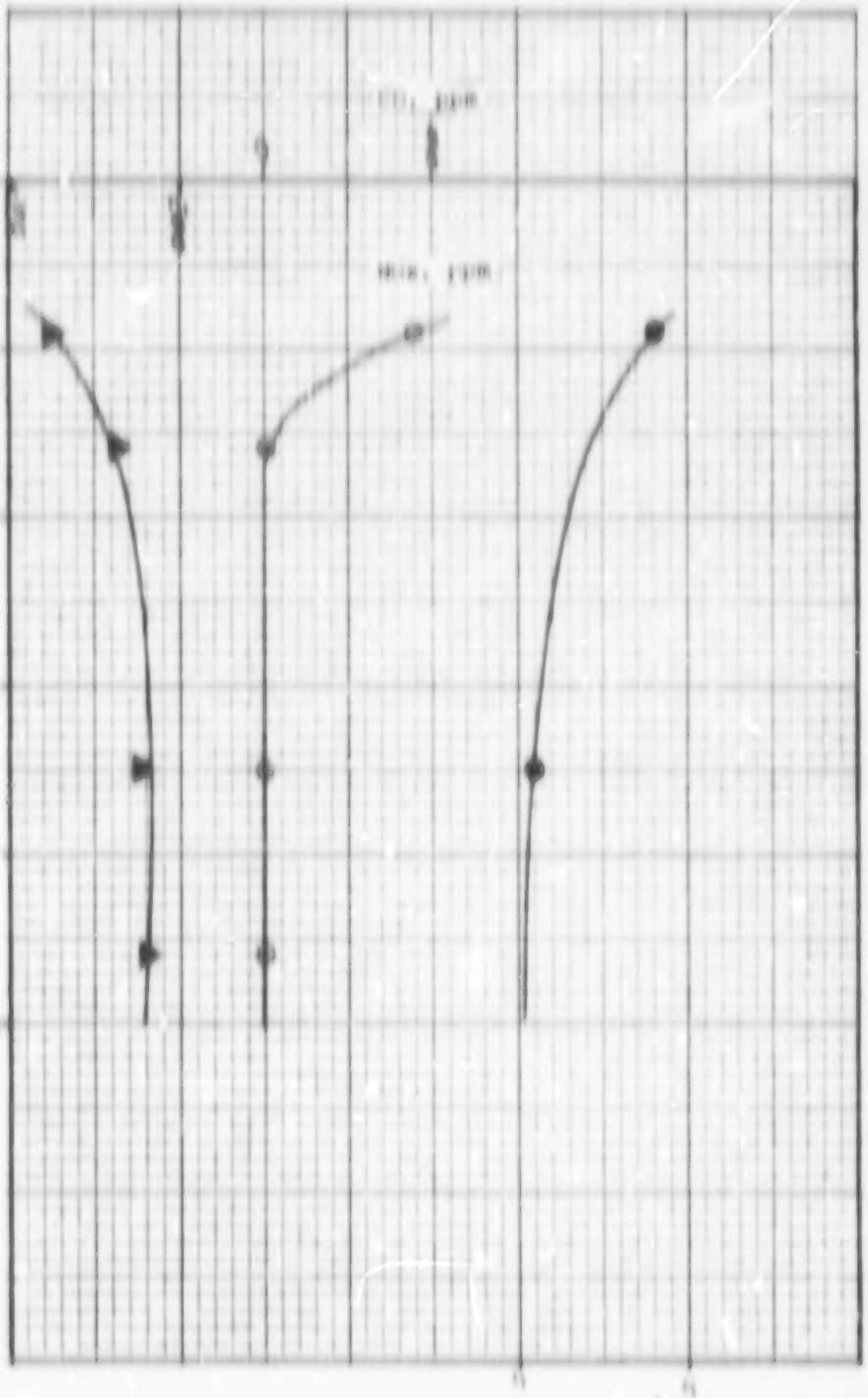
Location 19

Unit #2

Fuel Natural Gas (#2 oil)

Test No.	2NG 2	2NG 3	2NG 4	2NG 5	2NG 6	2NG 7	
Test Type	FGR	FGR	FGR	FGR	FGR	FGR	
Test Load (10^3 lb/hr)	19	19	18.9	18.9	19	18.8	
Excess O_2 (%)	3.0	2.8	3.2	2.8	3.0	3.2	
NO_x (ppm)*	93	92	99	101	96	102	
NO (ppm)*	92	92	99	101	96	102	
CO_2 Dry (%)	11.6	11.8	11.2	11.0	12	11.4	
CO (ppm)*	0	0	10	0	0	5	
HC (ppm)*	27	27	22	16	0	6	
NO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		81				81	
Smoke Spot No.	2	2	3	3	4	3	
Opacity (%)							
Final Stm Pres. (psig)	152	150	150	151	151	150	
Final Stm Temp. (°F)	Saturat.					▶	
Combus. Air Temp. (°F)	119	120	117	120	120	121	
Stack Temp. (°F)	598	596	598	598	598	598	
Fuel Flow (CFH)	1.03	1.05	1.04	1.04	1.0	1.0	
Fuel Temp. (°F)	199	198	200	201	202	202	
Fuel Pres. (psig)	25	25	25	25	25	25	
Furnace Pres. (in. H_2O)	0.55	0	0.05	0.7	0.02	0.02	
Register (# open)	1	80	80	80	80	80	

*at 3% O_2 dry



Bacharach Smoke No.

Location 10
Unit 2
Test 66 145 - 206

Fuel Analysis Summary

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Carbon Residue, %	Gravity, ° API	Higher Heating Value Btu/lb	Btu/lb
102–103	#2 Oil	85.94	13.72	0.09	0.40	0.045	0.003	–	0.071	31.1	0.0452	19,440
107–108	#2 Oil	85.94	13.72	0.09	0.40	0.045	0.003	–	0.071	31.1	0.0452	19,440
111–112	#5 Oil	86.46	10.31	1.07	1.29	0.77	0.10	–	8.50	15.1	0.0426	18,333
116–121	#5 Oil / #6 Oil	85.95	10.21	0.22	2.74	0.31	0.03	–	–	–	0.0421	18,213
126–131	#6 Oil	No Fuel Sample Obtained For Analysis										
131–133	Coal	62.50	5.31	12.52	1.15	0.83	10.5	7.35	–	–	0.0276	11,863
134–139	Coal	68.30	4.70	11.01	1.16	1.06	9.71	3.66	–	–	0.0286	12,293
156–159	Coal	69.09	4.67	8.10	1.36	1.50	14.48	3.37	–	–	0.0286	12,305
156	#6 Oil	85.44	11.35	0.0027	2.60	0.33	0.076	–	12.33	15.8	0.0432	18,580
160–164	#2 Oil	87.14	12.71	–	0.31	0.013	<0.001	–	0.027	35.1	0.0451	19,390
165–168	Coal	63.42	4.84	9.85	1.05	0.94	17.7	4.15	46.2	–	0.0276	11,873
169	Coal	62.50	5.12	12.51	1.15	0.83	10.5	7.35	–	–	0.0276	11,863
170–175	#6 Oil	86.60	10.94	0.31	1.60	0.30	0.25	–	9.00	15.1	0.0424	18,660
176–179	#6 Oil	86.17	11.55	–	1.91	0.30	0.07	–	–	–	0.0436	18,773
180–185	#6 Oil	85.10	11.30	3.12	0.19	0.49	0.08	–	8.53	35.7	0.0446	19,227
195–206	#6 Oil	86.68	12.16	0.65	0.37	0.16	0.009	–	1.61	25.2	0.0450	19,365

INDUSTRIAL BOILER DESIGN DATA

Location No. 19 Test No. 40-199 Unit No. 2

Unit Description Keeler Boiler Type D, Model WB-1-185

Installation Date	1970
Steam Output (10^3 lb/hr)	175
Design Pressure (psig)	250
Final Steam Temp (°F)	410
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9-6-8
Furnace Area (ft^2)	827
Furnace Volume (ft^3)	892
Burner Description	1 Faber Ring Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	490

Comments: Boiler was equipped with overfire air ports and flue gas recirculation ducting.

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location 19

Unit 1

Fuel Natural Gas

Test No.	190-1	190-2	190-3	190-4	190-5	190-6	190-7
Test Type	Control	Hi Ex	Normal Air	Normal Air	Normal Air	Low Air	Low Air
Test Load (10^3 lb/hr)	16	14	14	12.2	13.5	12.4	14
Excess O_2 (%)	3.2	3.7	3.2	2.8	3.2	2.6	2.6
NO_x (ppm)*	54	59	59	60	69	88	61
NO (ppm)*	50	58	57	60	68	83	61
O_2 dry (%)	9.8	9.6	10	10.2	9.8	10.2	10.4
CO (ppm)*	10	6	15	40	0	0	10
HC (ppm)*			6	0	0	13	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	86						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	169	159	150	149	151	157	163
Final Stm Temp. (°F)	Saturat						"
Combus. Air Temp. (°F)	95	110	110	98	90	115	97
Stack Temp. (°F)	558	630	620	571	520	571	550
Fuel Flow				2740	3100	2990	
Fuel Temp. (°F)	Amb						"
Fuel Pres. (psig) "H_2O	10	88	86	84	87	87	85
Furnace Pres. (in H_2O)	0.10	0.18	0.15	0.08	0.3	0.4	0.3
Register (% open)	60	60	60	60	80	90	60

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL RUN DATA

Location /0

Unit /

Fuel Natural Gas

Test No.	191-1	191-2	191-3	191-4	192-1	192-2	192-3
Test Type	Comb. Adj.	Effluent Adj.	Comb. Adj.	Comb. Adj.	FGR	FGR	FGR
Test Load (10^3 lb/hr)	8.4	14	14	14	14.2	14.2	13.5
Excess O_2 (%)	3.0	3.5	3.0	2.6	2.9	1.6	2.0
NO_x (ppm)*	54	55	55	58	27	81	29
NO (ppm)*	54	55	55	57	27	81	28
$(X)_2$ dry (%)	10.4	10	10.2	10.2	10	10.8	11.0
CO (ppm)*	11	0	16	15	0	102	89
HC (ppm)*					0	6	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			80		80		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	149	149	150	148	151	153	154
Final Stm Temp. (°F)	Sat'd.						"
Combus. Air Temp. (°F)	100	100	91	91	100	102	101
Stack Temp. (°F)	359	484	467	471	484	480	430
Fuel Flow ft³/min	0.8	0.9	0.82	0.82			
Fuel Temp. (°F)	Amb						"
Fuel Pres. (psig)	10	8.8	8.8	8.8	8.7	8.7	8.7
Furnace Pres. (in. H_2O)	0.6	0.38	0.32	0.35	0.5	0.9	0.56
Register (% open)	60	60	60	60	60	60	60

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND [illegible] FROM LIFE

Location /#

Unit #

Fuel *Natural Gas*

Test No.	1#2-4	#2-5	1#2-6	1#2-7	1#2-8	1#2-9	1#2-10
Test Type	FOR	FOR	FOR	FOR	FOR	FOR	FOR
Test load (10^3 lb/hr)	15.9	15.9	15.7	15.6	15.6	15.7	15.3
Excess O_2 (%)	2.0	1.9	2.2	2.0	2.5	2.3	2.6
NO_x (ppm)*	15	19	22	16	20	29	30
NO (ppm)*	08	19	22	16	20	28	30
O_2 dry (%)	10	10.5	10	10.2	10		10.5
CO (ppm)*	15	424	40	119	17	159	250
HC (ppm)*	0	22	10	06	42	0	42
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part.(lb/MBtu)							
Solid Part.(lb/MBtu)							
Boiler Efficiency (%)				80			
Smoke Spot No.							
Opacity (%)							
Final Stm Pres.(psig)	165	198	198	198	198	199	150
Final Stm Temp.(°F)	Sat.						"
Combus. Air Temp.(°F)	101	100	100	100	110	100	98
Stack Temp.(°F)	470	478	483	485	489	478	475
Fuel Flow *cfh/mcfh*		790					
Fuel Temp. (°F)	Amb						"
Fuel Pres. (psig)*in*	07.5	08.5		08	08	08	07
Furnace Pres.(in.H_2O)	0.2	0.5	0.6	0.6	0.05	0.4	0.55
Register (% open)	60	60	60	60	60	60	60

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL RXXR DATA

Location [illegible]

Unit [illegible]

Fuel Natural Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	SCA	SCA	SCA	SCA	SCA	SCA	SCA
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(O)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	Saturated						↵
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	Ambient						↵
Fuel Pres. (psig) W.C.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location /9

Unit 2

Fuel *Natural Gas*

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	SCA	SCA	SCA	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	14	15	15	14	14	14	14
Excess O_2 (%)	2	2	2	3	3	3	3
NO_x (ppm)*	77	53	58	50	40	40	41
NO (ppm)*	77	53	58	51	40	40	41
$(X)_2$ dry (%)	12	11	11	10	11	10	10
CO (ppm)*	0	10	0	15	250	10	9
HC (ppm)*	0	0	0	0	0	0	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MMtu)							
Solid Part. (lb/MMtu)							
Boiler Efficiency (%)	79	80		79			
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	151	155	152	153	153	151	150
Final Stm Temp. (°F)	Saturat						
Combus. Air Temp. (°F)	72	78	76	80	83	83	83
Stack Temp. (°F)	270	300	290	310	310	317	315
Fuel Flow *ft³/hour*	290			288	288	290	288
Fuel Temp. (°F)	Amb						
Fuel Pres. (psig)	28	36	35	30	28	28	28
Furnace Pres. (in H_2O)	0.4	0.3	0.3	0.32	0.35	0.28	0.28
Register (% open)	60	60	60	60	60	60	60

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Natural [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	[illegible]						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Final Stm Temp. (°F)	[illegible]					"	
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Temp. (°F)	[illegible]					"	
Fuel Pres. (psig) [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

*at 3% O_2 dry

Decrease for Industrial Boilers as a Function of Excess Oxygen

FUEL ANALYSIS SUMMARY

Gas Plant

Location [redacted]
Unit 2
Report No. [redacted]

Test No.	Type of Fuel	CH_4 %	C_2H_6 %	C_3H_8 %	C_4H_{10} %	C_5H_{12} %	C_6H_{14} %	O_2 %	CO_2 %	N_2 %	H_2O %	H_2O %	Properties: Higher Heating Value kcal/m³	Btu/lb	Higher Heating Value kcal/m³	Btu/ft³
[redacted]	Natural Gas	94.33	4.39	0.30	0.082	0.033	0.032	–	0.35	0.13	0.37	0.03	9.724	0.0547	9.0388	1043
[redacted]	Natural Gas	96.32	4.39	0.29	0.082	0.033	0.032	–	0.35	0.13	0.37	0.03	9.725	0.0547	9.0388	1041
[redacted]	Natural Gas	98.89	1.00	0.40	Trace	–	–	–	0.10	–	0.03	–	9.766	0.0602	9.0284	976
[redacted]	Natural Gas	98.11	0.31	0.09	0.13	0.09	0.03	–	0.47	–	1.06	0.04	9.703	0.0614	9.0371	1060
[redacted]	Natural Gas	98.11	0.31	0.09	0.13	0.04	0.03	–	0.47	–	1.06	0.04	9.760	0.0572	9.0371	1060
[redacted]	Natural Gas	98.8	1.06	0.31	0.09	0.03	0.03	–	–	–	–	–	9.722	0.0644	9.0351	1070
[redacted]	Natural Gas	94.49	3.30	1.39	0.43	0.33	–	0.083	1.45	–	1.03	–	9.760	0.0572	9.0384	1059
[redacted]	Natural Gas	97.93	0.37	0.31	–	–	–	0.33	0.74	–	–	–	9.722	0.0552	9.0388	1047
[redacted]	Natural Gas	98.99	1.00	0.32	0.09	0.03	–	–	0.69	–	0.29	–	9.716	0.0638	9.0377	1051
[redacted]	Natural Gas	97.36	1.40	0.037	0.09	–	–	–	0.37	0.01	0.39	–	9.765	0.0570	9.0391	1053
[redacted]	Natural Gas	98.45	95.96	1.09	0.13	0.01	–	95.437	–	0.07	2.49	–	9.570	0.0599	9.0316	933
	Fuel													–		

INDUSTRIAL BOILER DESIGN DATA

Location No. 150 Test No. 6 Unit No. 4

Unit Description CE Packaged Boiler Type 24 VP 120

Installation Date	1966
Steam Output (10^3 lb/hr)	80
Design Pressure (psig)	310
Final Steam Temp (°F)	600
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	24 · 7 · 10
Furnace Area (ft^2)	730
Furnace Volume (ft^3)	1750
Burner Description	Cyclone Steam Atom. Burners
Horiz. Burner Spacing (ft)	type 12 3230 with Dutch Registers
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	220
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	506

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location [illegible]

Unit 2

Fuel [illegible]

Test No.	1	2	3	4	5	6	7
Test Type	80% Air	40% Excess	80% Air	Low Excess	Design	120% Air	Low Air
Heat Input (10^3 lb/hr)	510	460	410	488	501.5	520.8	515
Excess O_2 (%)	5.0	8.2	7.0	6.6	5.7	9.7	9.0
NO_x (ppm)*	305	330	305	317	310	292	277
CO (ppm)*	290	319	290	275	304	260	260
CO_2 dry (%)	11.1	11.0	10.2	10.7	11.4	10.9	10.8
CO (ppm)*	0	0	0	0	0	0	82
HC (ppm)*							
SO_x (ppm)*	481						
SO_2 (ppm)*	468						
Total Part. (lb/MBtu)					0.1068		
Solid Part. (lb/MBtu)					0.0704		
Boiler Efficiency (%)		80		82	80	83	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1150	1059	1021	1080	1068	1145	1082
Final Stm Temp. (°F)	760	850	841	888	886	886	876
Combus. Air Temp. (°F)	Ambient						
Stack Temp. (°F)	317	424	388	371	386	382	356
Fuel Flow (GPH)	80	70.6	64	80	80.25	82	82
Fuel Temp. (°F)	109	108	104	110	107	106	100
Fuel Pres. (psig)	83	110	75	88	81	83	82
Furnace Pres. (in H_2O)	4	4.5	3.0	3.7	4.0	3.7	3.0
Register (% open)	50 - 65	55 - 85	45 - 50	60 - 60	50 - 85	45 - 65	45 - 55

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 4

Fuel #6 Oil

Test No.	8-8						
Test Type	Out 4.1						
Test Load (10^3 lb/hr)	52						
Excess O_2 (%)	3.4						
NO_x (ppm)*	470						
NO (ppm)*	386						
CO_2 dry (%)	11.6						
CO (ppm)*	0						
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1255						
Final Stm Temp. (°F)	1000						
Combus. Air Temp. (°F)	400						
Stack Temp. (°F)	370						
Fuel Flow (GPM)	8.2						
Fuel Temp. (°F)	250						
Fuel Pres. (psig)	85						
Furnace Pres. (in. H_2O)	0.0						
Register (% open)	42-45						

*at 3% O_2 dry

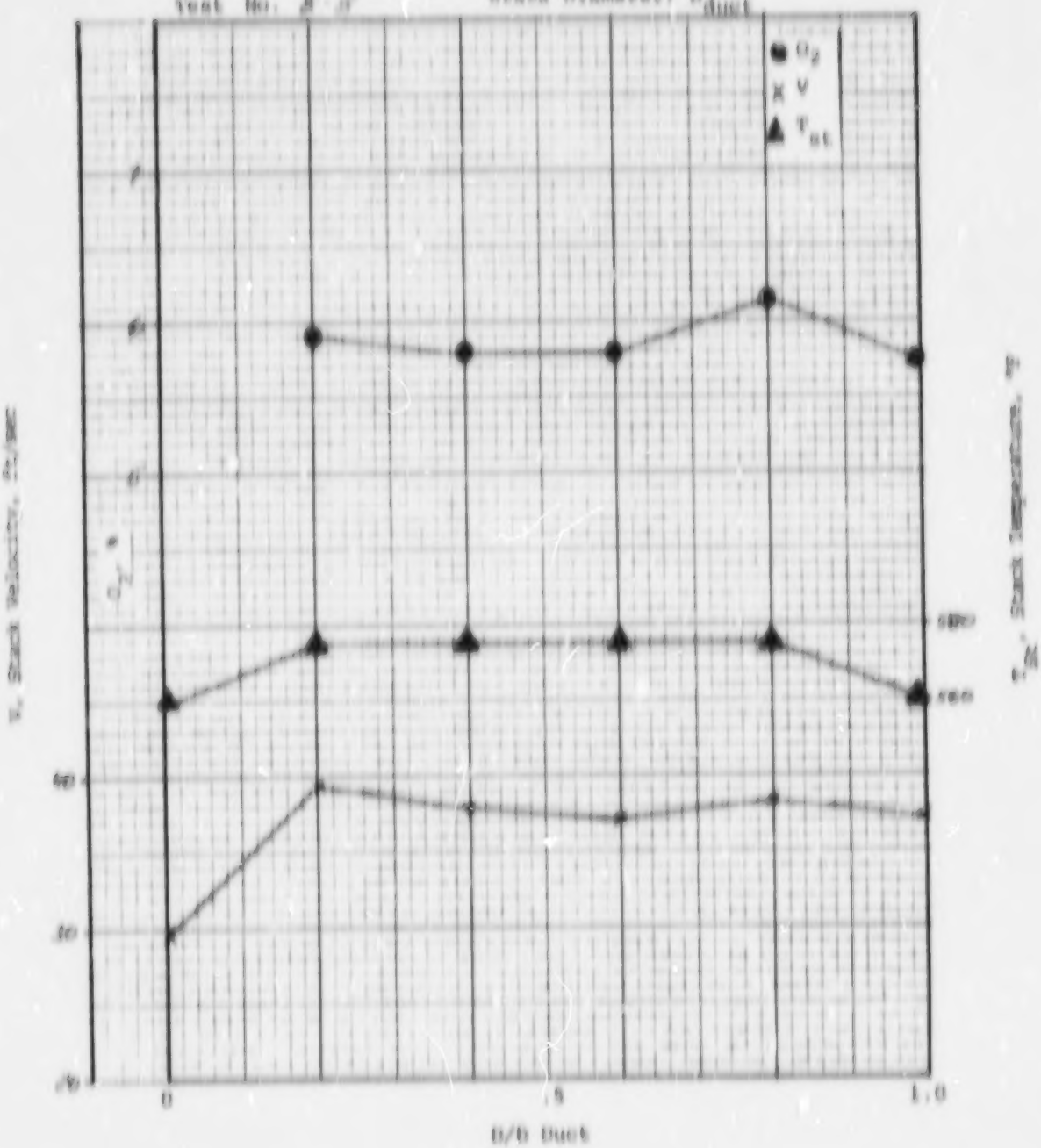
Emissions for Industrial Boilers as a Function of Excess Oxygen

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. [illegible] Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D_{duct}



K V B ENGINEERING, INC.
17662 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8060

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 8/1/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000

location of Unit 4 Test 8

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 74121-0

Sample Identification:

No. 1 5-21-74, Test 8, Oil No. 6, Unit No. 4; sample was taken from pump discharge pipe.

SEE FOLLOWING PAGE FOR SAMPLE RESULTS

Test #	No. 1
Carbon, %	86.09
Hydrogen, %	10.58
Ash, %	0.019
Carbon Residue, %	9.92
Flash Point, °C	146
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	18,500
Net, Btu/lb	17,540
API Gravity	15.0 at 76°F
Nitrogen, %	.17
Sulfur, %	1.49
Viscosity SSU	619 at 142°F
Oxygen, %	1.45

* The sample is too dark in color to determine the Aniline Point.

The results of the spectrographic analysis of the oils are as follows:

Parts Per Million in Oil

	No. 1
Vanadium	46.
Nickel	13.
Iron	35.
Silicon	6.1
Calcium	6.0
Aluminum	5.6
Sodium	4.0
Manganese	0.10
Barium	0.01
Magnesium	3.0
Lead	0.66
Chromium	0.25
Molybdenum	0.091
Tin	0.066
Copper	0.042
Silver	ND
Zinc	1.1
Titanium	0.21
Cobalt	ND
Strontium	0.21
Phosphorus	ND
Cadmium	ND

ND = not detected

(Continued)

INDUSTRIAL BOILER DESIGN DATA

Location No. [illegible] Test No. 32 Unit No. 43

Unit Description B&W 2 Drum Stirling Boiler, Size 350#

Installation Date	1967
Steam Output (10^3 lb/hr)	400
Design Pressure (psig)	1575
Final Steam Temp (°F)	900
Furnace Type	Watercooled
Furnace Size L-W-H (ft)	40 × 10
Furnace Area (ft^2)	377
Furnace Volume (ft^3)	1130
Burner Description	3 B&W Cyclones
Horiz. Burner Spacing (ft)	3'-3"
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	550
Stack Temp (°F)	500

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL SYSTEM DATA

Location [illegible]

Unit [illegible]

Fuel Coal

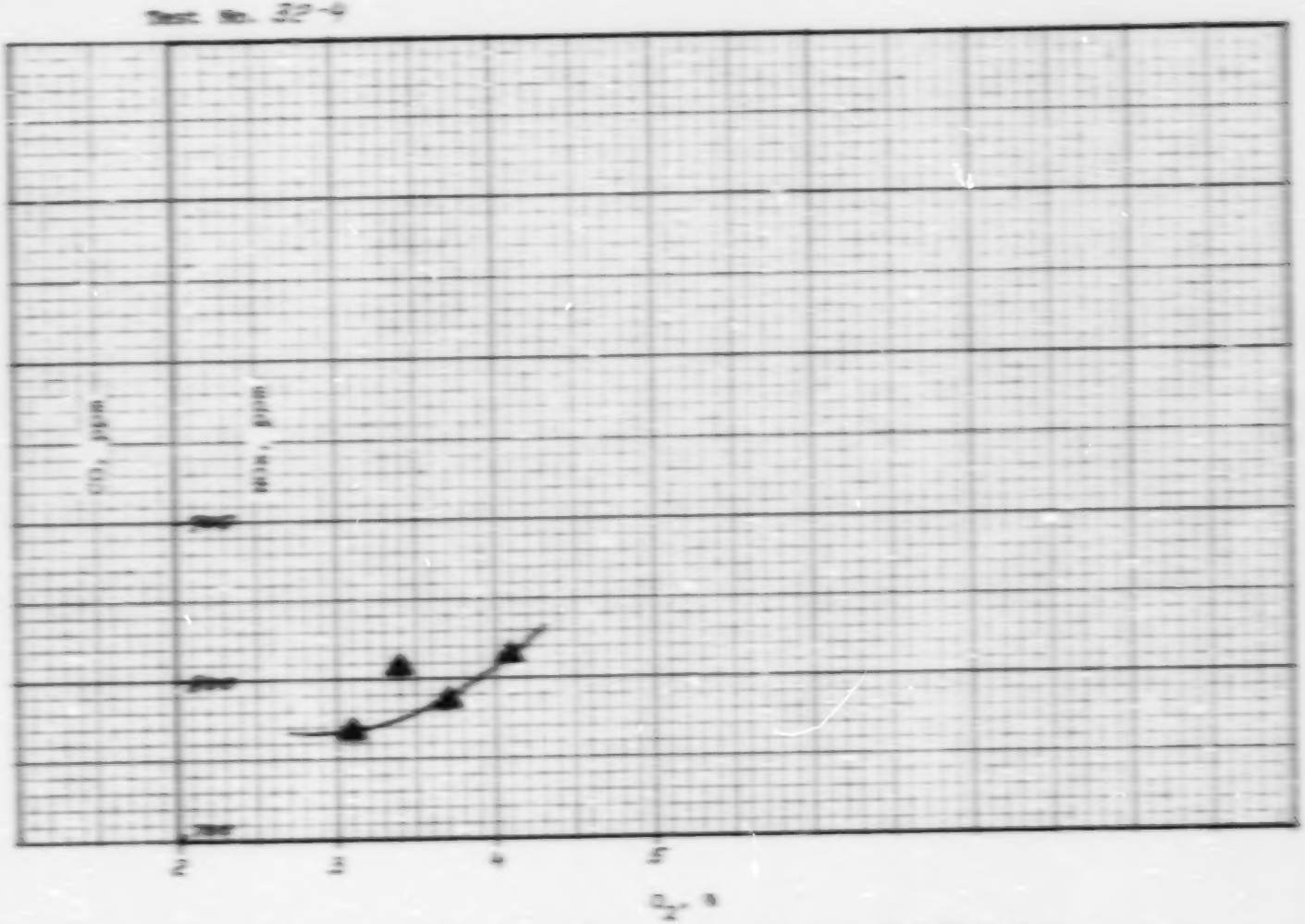
Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (lb/hr/10^3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

Location No. 20 Load 320,000 lb/hr ● Smoke ▯ HC

Unit No. 42 Fuel Coal ○ CO ▲ NO_x

Test No. 32-4



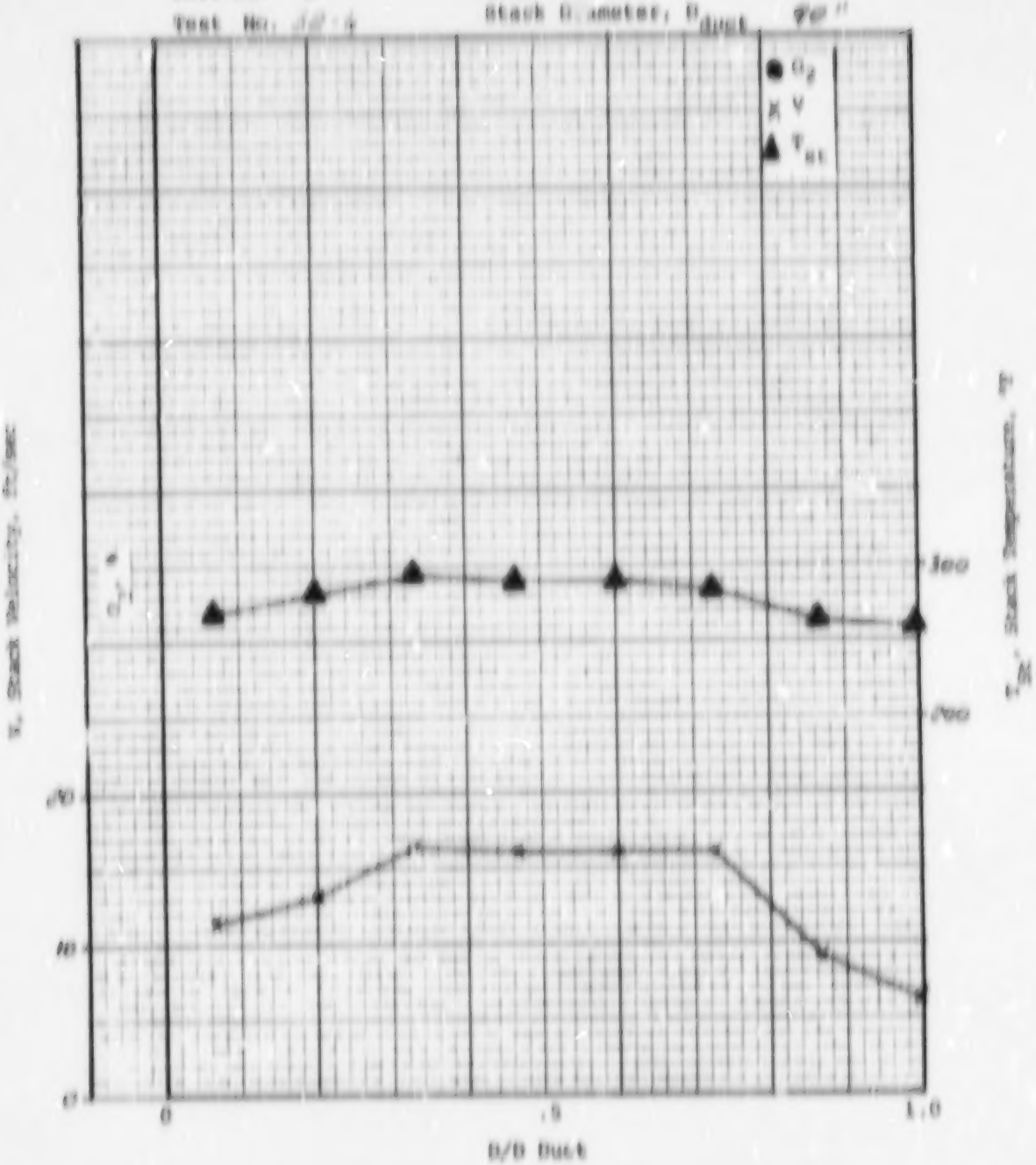
Emissions for Industrial Boilers as a Function of Excess Oxygen

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. [illegible] Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D_{duct} [illegible]



INDUSTRIAL BOILER DESIGN DATA

Location No. 6 Test No. 91 Unit No. 4

Unit Description B&W 2 Drum Stirling Boiler, 3,200 SFSB

Installation Date	1967
Steam Output (10^3 lb/hr)	400
Design Pressure (psig)	1575
Final Steam Temp (°F)	900
Furnace Type	Watertube
Furnace Size L-W-H (ft)	120 - 10
Furnace Area (ft^2)	377
Furnace Volume (ft^3)	1130
Burner Description	8 B&W Cyclones
Horiz. Burner Spacing (ft)	3'-3"
Vert. Burner Spacing (ft)	
Test Fuel	50% Coal, 50% #6 Oil
Fuel Temp at Burner (°F)	Amb for Coal, 190 for Oil
Primary Air Temp (°F)	~ 550
Stack Temp (°F)	~ 300

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit #3

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]				
Test Type	[illegible]	[illegible]	[illegible]				
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]				
Excess O_2 (%)	[illegible]	[illegible]	[illegible]				
NO_x (ppm)*	[illegible]	[illegible]	[illegible]				
NO (ppm)*	[illegible]	[illegible]	[illegible]				
CO_2 dry (%)	[illegible]	[illegible]	[illegible]				
CO (ppm)*	[illegible]	[illegible]	[illegible]				
HC (ppm)*							
SO_x (ppm)*	[illegible]	[illegible]	[illegible]				
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]				
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]				
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]				
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]				
Smoke Spot No.	[illegible]	[illegible]	[illegible]				
Opacity (%)	[illegible]	[illegible]	[illegible]				
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]				
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]				
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]				
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]				
Fuel Flow (Kilo#/hr) each oil	[illegible]	[illegible]	[illegible]				
Fuel Temp. (°F) each oil	[illegible]	[illegible]	[illegible]				
Fuel Pres. (psig) oil	[illegible]	[illegible]	[illegible]				
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]				
Register (% open)	[illegible]	[illegible]	[illegible]				

*at 3% O_2 dry

INDUSTRIAL BOILER DESIGN DATA

Location No. [illegible] Test No. 24 Unit No. 4E

Unit Description 8E&W 2 Drum Stirling Boiler, Size 5F8E

Installation Date	1967
Steam Output (10^3 lb/hr)	400
Design Pressure (psig)	1575
Final Steam Temp (°F)	900
Furnace Type	Waterwalls
Furnace Size L-W-H (ft)	120 - 10
Furnace Area (ft^2)	377
Furnace Volume (ft^3)	1130
Burner Description	8 E&W Cyclones
Horiz. Burner Spacing (ft)	3'-3"
Vert. Burner Spacing (ft)	
Test Fuel	70% Coal, 30% #6 Oil
Fuel Temp at Burner (°F)	Amb. for coal, 200 for oil
Primary Air Temp (°F)	~ 550
Stack Temp (°F)	~ 300

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL BOOK DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
$(NO_2$ dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (lb/hr)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

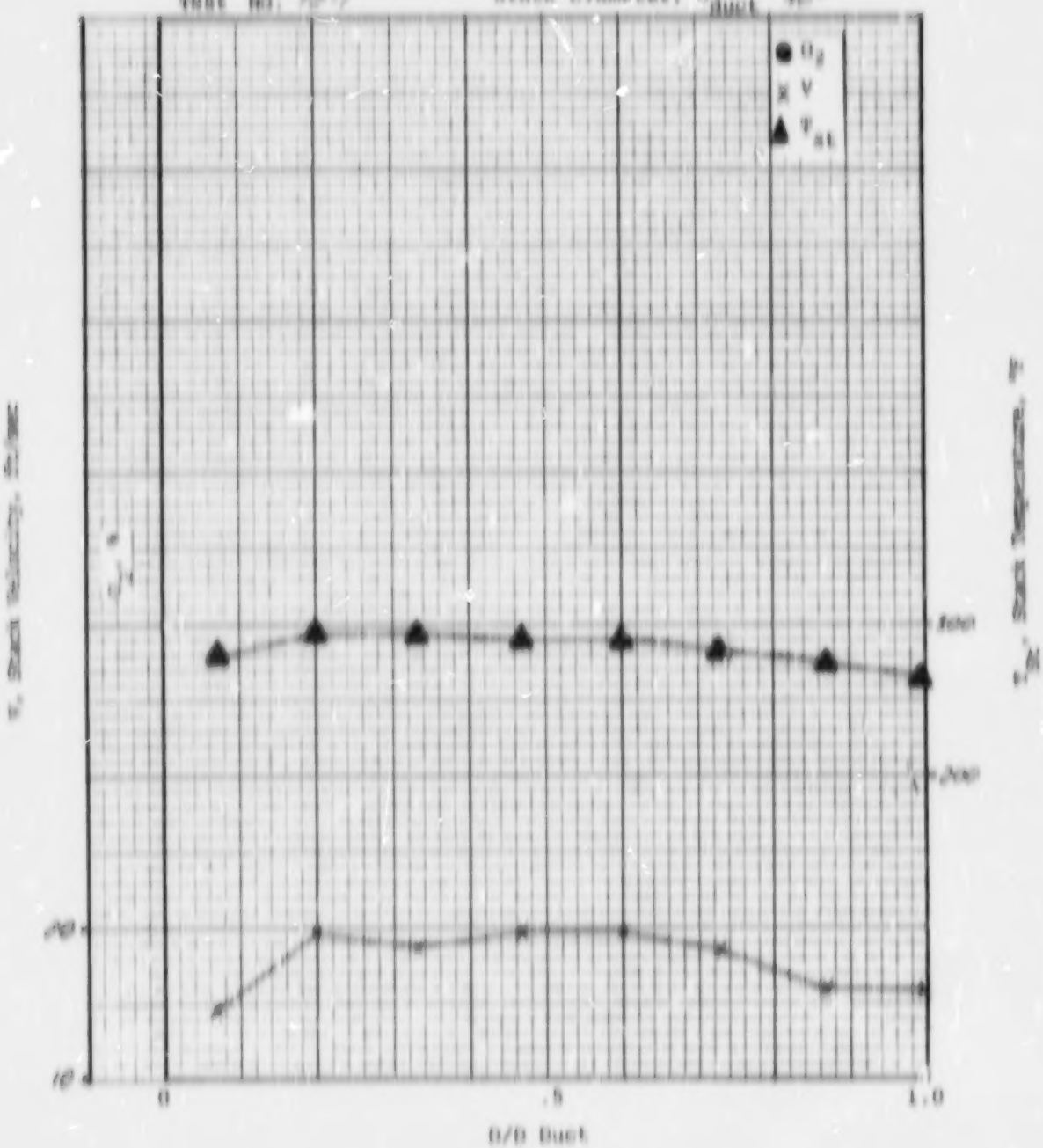
*at 3% O_2 dry

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. [illegible] Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D duct [illegible]



K V B ENGINEERING, INC.
[illegible] IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-6000

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, Calif.
Attn: G. Cato

DATE: 7/17/74

SAMPLES: 5 Coal Samples

RECEIVED: 5/10/74

KVB CHARGE NO.: 6000

ANALYZED: 6/25/74

INVESTIGATION: As Requested

LABORATORY NO: 74119[illegible]

Sample Identification:

No. 3 Test No. 32-1; May 22, 1974

	No. 3
Carbon, %	76.57
Hydrogen, %	5.54
Sulfur, %	2.23
Nitrogen, %	1.75
Ash, %	7.78
Oxygen (by difference)	5.64
Moisture, %	1.43
Carbon Residue, %	52.69
Heat of Combustion:	
Gross, Btu/lb	13,190
Net, Btu/lb	12,680

The results of a spectrographic analysis for trace metals will be reported as soon as available.

Locations 30
Unit 42
Tests 32, 71, 72

Respectfully submitted,

KVB Engineering, Inc.

J. George Sotter
Laboratory Director

TRUESDAIL LABORATORIES, INC.

CHEMISTS • MICROBIOLOGISTS • ENGINEERS
RESEARCH • DEVELOPMENT • TESTING

4101 N. FIGUEROA STREET
LOS ANGELES 90065
AREA CODE 213 • 225-1064
CABLE: TRUELABS

CLIENT KVB Engineering
17332 Irvine Blvd.
Tustin, CA 92680
Attn: Hans Buening

SAMPLE 6 Coals previously submitted for other analyses marked as shown

P.O. No. 2000

INVESTIGATION Determination of density

DATE August 7, 1974

RECEIVED August 1, 1974

LABORATORY NO. 1088

RESULTS

Correction on
Unit 42
Test 32, 71, 72

Test No.			Density (g/ml.)
32-1;	Unit 42,	5/23/74	1.318

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Alvin E. May

Alvin E. May
Director of Laboratories

KVB

Specific #'s
Coal #2
Test #1, #2

	No. 2
Carbon, %	86.64
Hydrogen, %	10.75
Ash, %	0.032
Carbon Residue, %	10.07
Flash Point, °C	132
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb.	18,560
Net, Btu/lb.	17,570
API Gravity	°F 14.6 at 70°
Nitrogen, %	.37
Sulfur, %	1.53
Oxygen, %	.68
Viscosity at 40°C	790 (at 58°C)

* Sample Oil too dark to determine Aniline Point

** To be turned in at a later date

Respectfully Submitted,

Kenneth W Corbett Jr

for J. George Sotter
Laboratory Director

Location #6
Coast Oil
Test #1, #2

	Parts Per Million in Oil No. 1
Vanadium	48.
Nickel	18.
Iron	9.6
Tin	0.88
Magnesium	8.3
Silicon	51.
Manganese	0.18
Lead	0.99
Aluminum	31.
Calcium	9.0
Molybdenum	0.17
Copper	0.096
Sodium	7.7
Zinc	0.61
Titanium	0.23
Cobalt	0.026
Strontium	0.18
Chromium	0.45
Barium	1.3
Phosphorus	ND
Silver	0.007

ND = not detected
*There was insufficient ash for a spectrographic analysis.

Respectfully submitted,

J. George Sutter

J. George Sutter
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. [illegible] Test No. 175-175 Unit No. 1

Unit Description Combustion Engineering Package Boiler Type [illegible]

Installation Date	1966
Steam Output (10^3 lb/hr)	80
Design Pressure (psig)	310
Final Steam Temp (°F)	600
Furnace Type	Watertube
Furnace Size L-W-H (ft)	24 - 9 - 10
Furnace Area (ft^2)	780
Furnace Volume (ft^3)	1470
Burner Description	1 Coen Steam Atom. Oil Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	150
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	630

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL RUN DATA

Location [illegible]
Unit [illegible]
Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
CO_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow [illegible]							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open) Secondary / Tertiary							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL NOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow GPM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in.H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open) Secondary / Tertiary	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL RUN DATA

Location [illegible]

Unit 4

Fuel #6 oil

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible] Air	[illegible] Air	[illegible] Air	[illegible] Air	Viscosity	Viscosity	Viscosity
Test Load (10^3 lb/hr)	60	[illegible]	[illegible]	68	60	[illegible]	68
Excess O_2 (%)	3.8	3.1	2.7	3.8	3.8	3.8	3.3
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	12.6	[illegible]	13.7	12.9	[illegible]	13.2	13.4
CO (ppm)*	10	0	[illegible]	10	[illegible]	0	11
HC (ppm)*	11	0	9	0	9	0	13
NO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			84				
Smoke Spot No.	4	4	4	4	3		
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	95	93	92	90	84	85	85
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow GPH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open) Secondary Windbox	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location: [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
O_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow GPH							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit #

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
$(O)_2$ dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow GPM							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (9 open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 9

Fuel #6 Oil

Test No.	124-9	124-10	124-11	124-12	124-13	124-14	124-15
Test Type	Air Htg						
Test Load (10^3 lb/hr)	61	62	63	63	63	62	63
Excess O_2 (%)	3.5	3.5	3.5	3.5	3.6	3.5	3.5
NO_x (ppm)*	258	267	260	253	236	265	270
NO (ppm)*	256	266	258	251	236	259	268
CO_2 dry (%)	13.1	13.9	13.8	13.8	13.8	13.8	13.9
CO (ppm)*	41	51	56	91	88	51	41
HC (ppm)*	0	0	11	11	9	0	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	2658	2651	2654	2654	2654	2654	2653
Final Stm Temp. (°F)	5975	5950	5950	5950	5950	5950	5950
Combus. Air Temp. (°F)	90	91	91	91	91	91	90
Stack Temp. (°F)	695	697	695	695	690	690	690
Fuel Flow GPM	630	630	630	630	630	630	630
Fuel Temp. (°F)	170	170	170	170	170	170	170
Fuel Pres. (psig)	107	108	108	108	108	108	108
Furnace Pres. (in. H_2O)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Register (% open) Primary/Secondary	70 - 70	75 - 70	80 - 70	80 - 70	90 - 70	80 - 70	80 - 70

*At 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 6

Fuel #6 B.I

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
CO_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (GPM)							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 4

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	Air Reg.						
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open) [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	Air Prog.						"
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (° open) [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL AGOR DATA

Location [illegible]

Unit 4

Fuel #6 Oil

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	Acc Req						
Test Load (10^3 lb/hr)	6.1	6.2	6.2	6.2	6.2	6.2	6.2
Excess O_2 (%)	3.6	3.5	3.6	3.2	3.4	3.4	3.4
NO_x (ppm)*	247	258	264	260	262	271	278
NO (ppm)*	244	256	262	257	261	270	276
CO_2 dry (%)	12.6	12.5	12.3	12.6	12.5	12.7	13.1
CO (ppm)*	8					41	15
HC (ppm)*	6					18	10
NO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	264	264	264	264	264	264	264
Final Stm Temp. (°F)	597	595	595	592	592	592	592
Combus. Air Temp. (°F)	82	82	82	84	84	84	84
Stack Temp. (°F)	628	629	626	625	626	629	635
Fuel Flow GPM	6.30	6.30	6.30	6.30	6.30	6.30	6.30
Fuel Temp. (°F)	132	132	132	130	130	130	130
Fuel Pres. (psig)	110	110	110	110	110	110	110
Furnace Pres. (in. H_2O)	5.9	6.0	6.0	5.8	5.9	5.9	5.9
Register (% open)	70 - 70	70 - 65	70 - 70	65 - 70	65 - 70	65 - 80	65 - 65

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 4

Fuel #6 Oil

Test No.	174-44	175-1	175-2	175-3	175-4	175-5	175-6
Test Type	4 Burner	[illegible]	[illegible]	[illegible]	[illegible]	4 Burner [illegible]	[illegible]
Test Load (10^3 lb/hr)	68	68	68	68	64	65.5	65.6
Excess O_2 (%)	3.3	3.4	3.8	3.0	3.4	3.2	3.8
NO_x (ppm)*	268	267	258	240	258	250	240
HC (ppm)*	256	265	256	259	257	254	258
$(S)_2$ dry (%)	13	12.9	13.2	13.9	13.8	13.1	13.3
CO (ppm)*	0	0	0	20	0	30	29
HC (ppm)*	0	0	10	11	0	14	18
NO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)						0.070	
Solid Part. (lb/MBtu)						0.050	
Boiler Efficiency (%)						81	
Smoke Spot No.						2	
Opacity (%)							
Final Stm Pres. (psig)	268	269	264	267	265	269	265
Final Stm Temp. (°F)	592	570	592	589	590	590	590
Combus. Air Temp. (°F)	99	98	93	93	89	90	91
Stack Temp. (°F)	655	642	653	650	650	650	653
Fuel Flow GPM	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Fuel Temp. (°F)	170	168	169	168	170	170	170
Fuel Pres. (psig)	110	110	110	110	108	109	108
Furnace Pres. (in. H_2O)	5.8	5.9	5.8	6.0	6.0	5.8	5.8
Register (# open)	5-60	8-70	8-70	8-70	8-70	8-70	8-70

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.		171-6A	171-6B	171-8	170-5A
Location No.		50	50	50	50
Fuel Type		#6 0.1	#6 0.1	#6 0.1	#6 0.1
Burner Type		Steam Atom			→
Test Load (lb/hr x 10^3)		50	60	61	69
Stack Temp (°F)		570	570	585	578
Stack Press. (in.H_2O)		-0.7	-0.7	-0.7	0.75
Impactor ΔP (in.H_2O)		4.0	4.0	4.0	4.0
Gas Volume (cm^3)		234,700	240,400	234,700	240,400
Impactor Flow ($cm^3 \cdot s^{-1}$)		20.1	20.6	20.1	20.8
Sample Time (sec)		7200	7200	7200	11,800
Orientation		Horizontal			→
D_{50} Cyclone (μm)					
Cascade Impactor Data	1 (μm)	3.56	3.37	3.56	3.18
	2 (μm)	2.02	1.96	2.02	1.91
	3 (μm)	1.35	1.31	1.35	1.27
	4 (μm)	0.67	0.66	0.67	0.64
	5 (μm)	0.34	0.33	0.34	0.32
Cascade Impactor Catch	Cyclone (mg)	None			→
	Stage 1 (mg)	0.588	1.052	1.000	1.742
	Stage 2 (mg)	0.010	0.182	0.301	0.852
	Stage 3 (mg)	0.382	0.258	0.256	0.512
	Stage 4 (mg)	0.172	0.132	0.108	0.164
	Stage 5 (mg)	0.100	0.088	0.108	0.256
	Filter (mg)	1.100	1.120	1.192	0.288
Total Catch (mg)		2.408	2.200	2.274	3.814
Comments		Baseline	Baseline	Baseline	Baseline

CASCADE IMPACTOR DATA

Test No.		175-58			
Location No.		2C			
Fuel Type		#2 Oil			
Burner Type		Todd Alum			
Test Load (lb/hr x 10^3)		64			
Stack Temp (°F)		577			
Stack Press. (in.H_2O)		1.93			
Impactor ΔP (in.H_2O)		7.07			
Gas Volume (cm^3)		370,600			
Impactor Flow ($cm^3 \cdot s^{-1}$)		34.5			
Sample Time (sec)		10,800			
Orientation		Horizontal			
D_{50} Cyclone (μm)		———			
Stage Cut Diameters	1 (μm)	2.93			
	2 (μm)	1.36			
	3 (μm)	1.17			
	4 (μm)	0.59			
	5 (μm)	0.29			
Catch Weights	Cyclone (mg)	46.10			
	Stage 1 (mg)	3.82			
	Stage 2 (mg)	1.86			
	Stage 3 (mg)	0.92			
	Stage 4 (mg)	0.32			
	Stage 5 (mg)	0.81			
	Filter (mg)	3.15			
Total Catch (mg)		160.250			
Comments		All Weights			

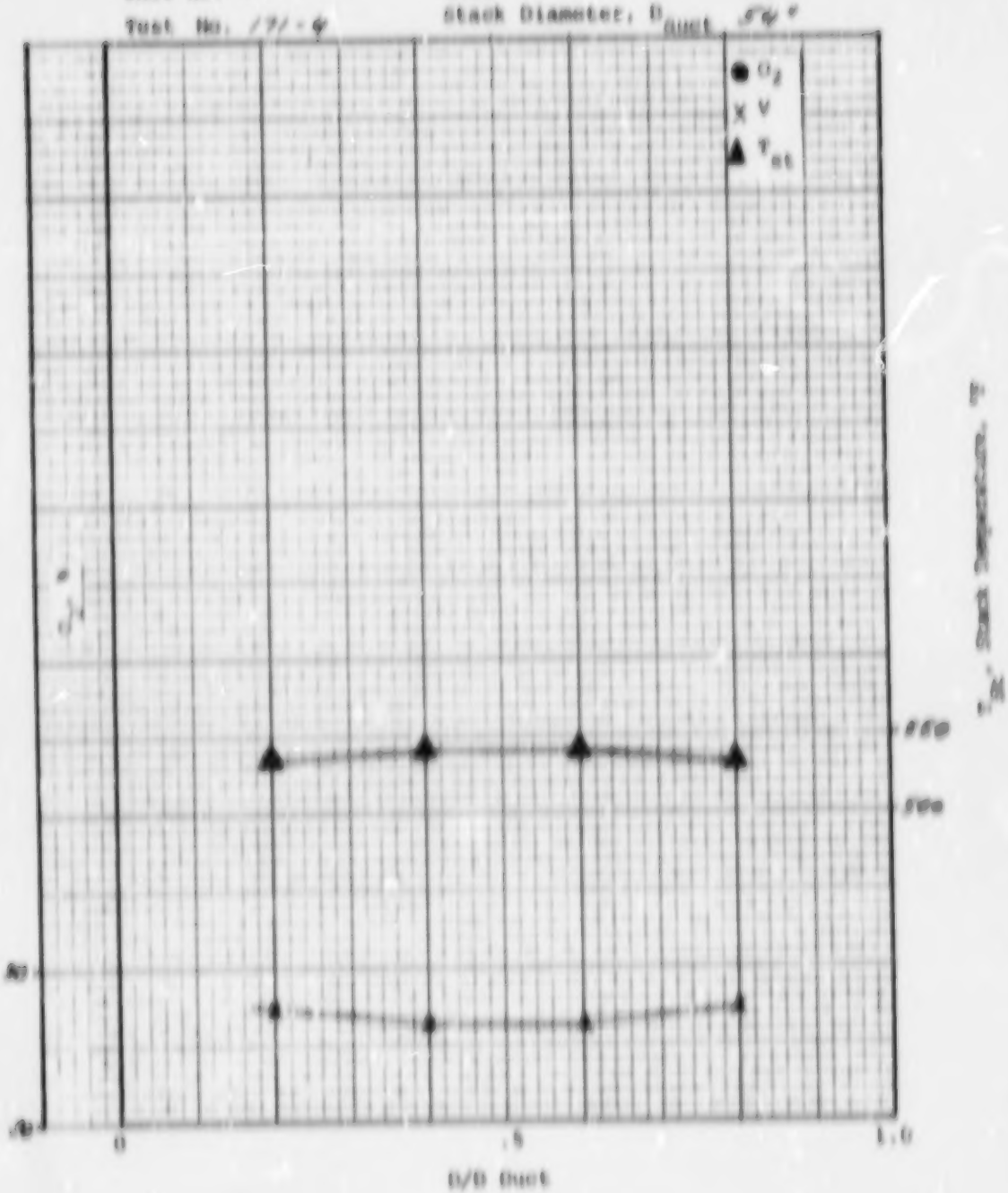
Background smoke No.

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. [illegible] Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D_{duct} [illegible]



Location 20
Unit 4
Test No. 172 - 175

FUEL ANALYSIS SUMMARY

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Carbon Dioxide, %	Gravity, API @ 60°	Higher Heating Value GJ/kg	Higher Heating Value Btu/lb
102-103	#2 Oil	85.94	13.72	0.09	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
107-108	#2 Oil	85.94	13.72	0.09	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
111-112	#5 Oil (85 Oil)	86.46	10.38	1.07	1.29	0.77	0.10	-	0.50	25.1	0.0436	18,333
116-121	#6 Oil	85.95	10.22	0.22	2.70	0.31	0.03	-	-	-	0.0423	18,191
126-130	#6 Oil	No Fuel Sample Obtained For Analysis										
131-133	Coal	62.50	5.31	12.52	3.15	0.83	10.5	7.29	-	-	0.0276	11,863
134-139	Coal	68.30	4.70	11.01	3.16	1.46	9.71	3.66	-	-	0.0296	12,293
156-159	Coal	69.69	4.67	8.30	1.36	1.50	14.48	3.37	-	-	0.0296	12,300
159	#6 Oil	85.44	11.35	0.662	2.80	0.33	0.038	-	12.33	15.8	0.0432	18,580
160-164	#2 Oil	87.14	12.71	-	0.31	0.013	<0.001	-	0.027	35.1	0.0451	19,390
165-168	Coal	63.47	4.84	9.85	3.05	0.94	13.7	4.15	46.2	-	0.0276	11,871
169	Coal	62.50	5.12	12.53	3.15	0.83	10.5	7.29	-	-	0.0276	11,863
170-175	#6 Oil	85.63	10.94	0.31	1.60	0.30	0.25	-	9.80	15.1	0.0434	18,660
176-179	#6 Oil	86.17	11.55	-	1.91	0.30	0.07	-	-	-	0.0436	18,773
180-189	#6 Oil	85.10	11.10	3.12	0.19	0.49	0.08	-	8.53	25.7	0.0446	19,227
195-196	#6 Oil	86.69	12.16	0.65	0.37	0.34	0.003	-	1.63	29.2	0.0450	19,365

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INDUSTRIAL BOILER DESIGN DATA

Location No. 21 Test No. 19 Unit No. 2

Unit Description CE Furnace

Installation Date	1967
Steam Output (10^3 lb/hr)	80
Design Pressure (psig)	265
Final Steam Temp (°F)	415
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	11 : 12 : 22
Furnace Area (ft^2)	1270
Furnace Volume (ft^3)	2890
Burner Description	2 Riley Spreader Stokers
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	300

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL IRON DATA

Location [illegible]

Unit [illegible]

Fuel Coal

Test No.	19-1	19-2	19-3	19-4	19-5	19-6	19-7
Test Type	H Air	Reduced Air	Reduced Air	Reduced Air	H Load	Base	Low Load
Test Load (10^3 lb/hr)	40	44	48	50	41	40	32
Excess O_2 (%)	9.4	8.8	6.9	5.8	7.4	8.0	9.0
NO_x (ppm)*	476	481	396	385	471	464	460
NO (ppm)*	468	473	389	379	464	457	454
CO_2 dry (%)	9.9	10.8	12.4	13.2	11.4	11.0	9.8
CO (ppm)*	62	85	99	96	53	35	38
HC (ppm)*	19	18	6	6	6	16	14
SO_x (ppm)*	1816						
SO_2 (ppm)*	1799						
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)					79	81	79
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1800	1800	1805	1805	1805	1805	1800
Final Stm Temp. (°F)	915	915	915	915	915	915	915
Combus. Air Temp. (°F)	Ambient						"
Stack Temp. (°F)	510	500	500	500	500	500	480
Fuel Flow							
Fuel Temp. (°F)	Ambient						"
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.08	-0.07	-0.08	-0.07	-0.08	-0.07	-0.085
Registers (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit #

Fuel Coal

Test No.	[illegible]	[illegible]					
Test Type	[illegible]	[illegible]					
Test Load (10^3 lb/hr)	[illegible]	[illegible]					
Excess O_2 (%)	[illegible]	[illegible]					
NO_x (ppm)*	[illegible]	[illegible]					
NO (ppm)*	[illegible]	[illegible]					
CO_2 dry (%)	[illegible]	[illegible]					
CO (ppm)*	[illegible]	[illegible]					
HC (ppm)*	[illegible]	[illegible]					
SO_x (ppm)*	[illegible]	[illegible]					
SO_2 (ppm)*	[illegible]	[illegible]					
Total Part. (lb/MMBtu)	[illegible]	[illegible]					
Solid Part. (lb/MMBtu)	[illegible]	[illegible]					
Boiler Efficiency (%)	[illegible]	[illegible]					
Smoke Spot No.	[illegible]	[illegible]					
Opacity (%)	[illegible]	[illegible]					
Final Stm Pres. (psig)	[illegible]	[illegible]					
Final Stm Temp. (°F)	[illegible]	[illegible]					
Combus. Air Temp. (°F)	[illegible]	[illegible]					
Stack Temp. (°F)	[illegible]	[illegible]					
Fuel Flow	[illegible]	[illegible]					
Fuel Temp. (°F)	[illegible]	[illegible]					
Fuel Pres. (psig)	[illegible]	[illegible]					
Furnace Pres. (in. H_2O)	[illegible]	[illegible]					
Register (% open)	[illegible]	[illegible]					

*at 3% O_2 dry

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K V B ENGINEERING, INC.
17872 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8060

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, Calif.
Attn: G. Cato

DATE: 7/17/74

SAMPLES: 5 Coal Samples

RECEIVED: 6/18/74

KVB CHARGE NO.: 6000

ANALYZED: 6/25/74

INVESTIGATION: As Requested

LABORATORY NO: 741190

Sample Identification:

No. 5 Test No. 19; Unit 2, May 31, 1974

	No. 5
Carbon, %	76.22
Hydrogen, %	5.40
Sulfur, %	0.76
Nitrogen, %	1.45
Ash, %	6.75
Oxygen (by difference)	9.42
Moisture, %	2.12
Carbon Residue, %	53.21
Heat of Combustion:	
Gross, Btu/lb	13,750
Net, Btu/lb	13,250

The results of a spectrographic analysis for trace metals will be reported as soon as available.

Location #1
Unit 2
Test 19

Respectfully submitted,

J. George Sutter
Laboratory Director

K V B ENGINEERING, INC.
17500 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-9000

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA

Attn: G. Cato

DATE: 7/19/74

SAMPLES: 5 Coal Samples

RECEIVED: 6/18/74

KVB CHARGE NO.: 6000

ANALYZED: 6/25/74

INVESTIGATION: Spectrographic Analysis of Coal - Supplement to 741190

LABORATORY NO: 741190

Sample Identification:

No. 5 Test No. 19; , Unit 2, May 31, 1974

Parts Per Million In Coal

	No. 5
Silicon	16,000
Aluminum	11,000
Iron	5,000
Calcium	1,600
Magnesium	680
Titanium	550
Copper	9.4
Barium	100
Beryllium	trace
Boron	53
Manganese	20
Lead	23
Nickel	11
Tin	trace

0 = not detected

KVB

Location 31
Unit 8
Test 19

Parts Per Million In Coal

	No. 5
Vanadium	0.1
Silver	ND
Sodium	460
Cobalt	6.5
Zirconium	14
Strontium	140
Potassium	ND
Chromium	28

ND = not detected

This completes the laboratory report for the five coal samples.

Respectfully submitted,

Kenneth R. Coffee

Lee, J. George Sotter,
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 01 Test No. 20 Unit No. 3

Unit Description Riley Boiler, Serial No. B-2307/3260

Installation Date	1925 ?
Steam Output (10^3 lb/hr)	25
Design Pressure (psig)	265
Final Steam Temp (°F)	415
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	18 - 16 - 15
Furnace Area (ft^2)	2076
Furnace Volume (ft^3)	3260
Burner Description	3 Riley Spreader Stokers
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	630

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 3

Fuel Coal

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	Normal	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	60	61	60	63	63	63	56
Excess O_2 (%)	7.6	8.2	9.6	6.5	6.6	7.8	6.9
NO_x (ppm)*	506	481	526	387	435	463	414
NO (ppm)*	506	479	517	383	423	459	408
$(O)_2$ dry (%)	11	10.8	9.7	12.0	12	10.3	12.6
CO (ppm)*	80	127	135	104	94	122	131
HC (ppm)*	22	40	20	13	13	16	16
SO_x (ppm)*	1698						
SO_2 (ppm)*	1665						
Total Part. (lb/MBtu)						0.259	
Solid Part. (lb/MBtu)						0.1915	
Boiler Efficiency (%)						86	87
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	2362	2365	2366	2360	2366	2355	2365
Final Stm Temp. (°F)	915	915	915	915	915	915	915
Combus. Air Temp. (°F)	Amb.						"
Stack Temp. (°F)	650	650	655	600	650	650	600
Fuel Flow							
Fuel Temp. (°F)	Amb.						"
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.12	-0.09	-0.09	-0.09	-0.09	-0.09	-0.13
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL EQUIP DATA

Location [illegible]

Unit 8

Fuel Coal

Test No.	[illegible]	[illegible]	[illegible]				
Test Type	Ab[illegible]	low load	low A.r				
Test Load (10^3 lb/hr)	52	44	68				
Excess O_2 (%)	9.3	9.9	5.9				
NO_x (ppm)*	506	489	389				
NO (ppm)*	490	472	377				
CO_2 dry (%)	9.6	8.9	12.6				
CO (ppm)*	92	99	71				
HC (ppm)*	21	27	23				
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)			0.039				
Solid Part. (lb/MBtu)			0.004				
Boiler Efficiency (%)		85	79				
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	2364	2362	2358				
Final Stm Temp. (°F)	915	915	915				
Combus. Air Temp. (°F)	Amb.		"				
Stack Temp. (°F)	620	580	600				
Fuel Flow							
Fuel Temp. (°F)	Amb.		"				
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.08	-0.1	-0.18				
Register (% open)							

*at 3% O_2 dry

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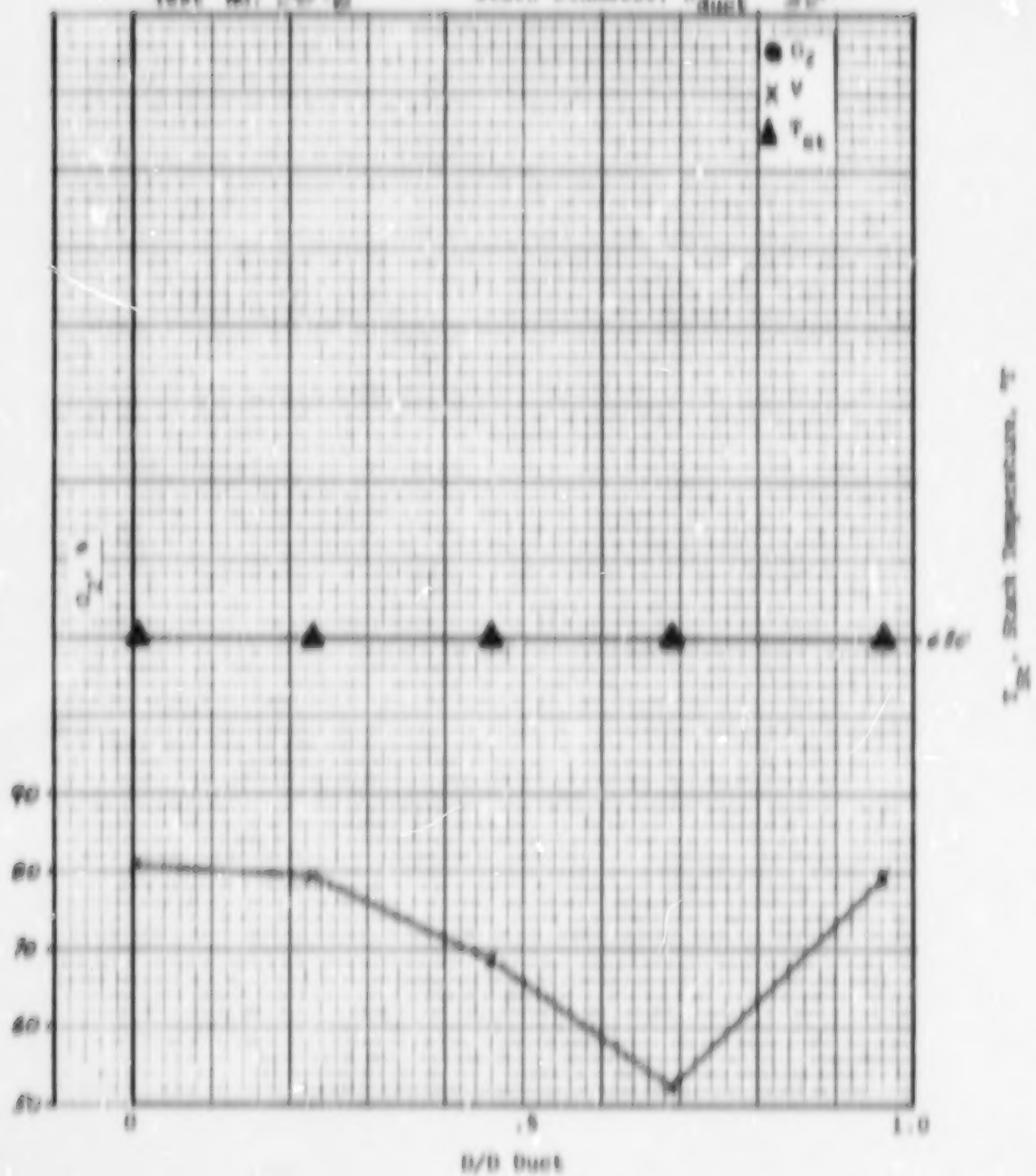
STACK TRAVERSE DATA

Location No. 01
Unit No. 5
Test No. 1-87-65

Fuel Coal
Load 68,000 lb/hr
Stack Diameter, D_{duct} 6'0"



KVB ENGINEERING, INC.
17872 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8080

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, Calif.
Attn: G. Cato

DATE: 7/17/74

SAMPLES: 5 Coal Samples

RECEIVED: 6/18/74

KVB CHARGE NO.: 6000

ANALYZED: 6/25/74

INVESTIGATION: As Requested

LABORATORY NO: 74119C

Sample Identification:

No. 4 Test No. 20-1; Unit No. 1, May 28, 1974

	No. 4
Carbon, %	75.85
Hydrogen, %	5.39
Sulfur, %	1.55
Nitrogen, %	1.43
Ash, %	6.94
Oxygen (by difference)	8.84
Moisture, %	1.56
Carbon Residue, %	59.10
Heat of Combustion:	
Gross, Btu/lb	13,800
Net, Btu/lb	13,300

The results of a spectrographic analysis for trace metals will be reported as soon as available.

Respectfully submitted,

KVB Engineering, Inc.

Leo J. George Sotter
Laboratory Director

K V B ENGINEERING, INC.
17300 IRVINE BLVD
TUSTIN, CALIFORNIA 92680
(714) 832-9010

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA

Attn: G. Cato

DATE: 7/19/74

Locations #1

SAMPLES: 5 Coal Samples — Unit 3

RECEIVED: 6/18/74

KVB CHARGE NO.: 6000 — Test 20

ANALYZED: 6/25/74

INVESTIGATION: Spectrographic Analysis of Coal - Supplement to 741190

LABORATORY NO: 741190

Sample Identification:

No. 4 Test No. 20-1; Unit No. 3, May 28, 1974

Parts Per Million in Coal

	No. 4
Silicon	10,000
Aluminum	9,000
Iron	5,200
Calcium	2,700
Magnesium	680
Titanium	380
Copper	6.1
Barium	76
Beryllium	ND
Boron	58
Manganese	24
Lead	15
Nickel	6.7
Tin	trace

ND = not detected

Locations of Coal Test #0

Parts Per Million in Coal	No. 4
Vanadium	6.9
Silver	0.58
Sodium	480
Cobalt	3.4
Zirconium	15
Strontium	97
Potassium	ND
Chromium	25

ND = not detected

This completes the laboratory report for the five coal samples.

Respectfully submitted,

J. George Sutter,
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. CAP Test No. 82 Unit No. 1

Unit Description Fitzsville Boiler, Class APPD-217

Installation Date	1948
Steam Output (10^3 lb/hr)	10
Design Pressure (psig)	125
Final Steam Temp (°F)	356
Furnace Type	Firetube
Furnace Size L-W-H (ft)	
Furnace Area (ft^2)	
Furnace Volume (ft^3)	
Burner Description	1 Winkler Underfeed Stoker
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	390

Comments:

BOILER EMISSION MEASUREMENTS

ABU CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel Coal

Test No.	82-1						
Test Type	Base						
Test Load (10^3 lb/hr)	8						
Excess O_2 (%)	14.9						
NO_x (ppm)*	268						
NO (ppm)*	268						
$(O)_A$ dry (%)	9.8						
CO (ppm)*	325						
HC (ppm)*	———						
$(SO)_A$ (ppm)*	———						
$(SO)_A$ (ppm)*	———						
Total Part. (lb/MBtu)	0.0102						
Solid Part. (lb/MBtu)	0.0099						
Boiler Efficiency (%)	———						
Smoke Spot No.	———						
Opacity (%)	———						
Final Stm Pres. (psig)	100						
Final Stm Temp. (°F)	540						
Combus. Air Temp. (°F)	Amb						
Stack Temp. (°F)	290						
Fuel Flow	———						
Fuel Temp. (°F)	Amb						
Fuel Pres. (psig)	———						
Furnace Pres. (in. H_2O)	———						
Register (% open)	———						

*at 3% O_2 dry

K V B ENGINEERING, INC.
17800 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8000

CHEMICAL LABORATORY REPORT

DATE: 8/9/74

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

SAMPLES: 2 Coal Samples — *Location EE Unit 1 Test 42*
KVB CHARGE NO.: 6000
INVESTIGATION: As Requested

RECEIVED: 7/16/74
ANALYZED: 7/24/74
LABORATORY NO: 74121-C

Sample Identification:

No. 1 Tests No. 42 and 43; Unit 1 and 2, 6/3/74

	No. 1
Carbon, %	77.09
Hydrogen, %	5.61
Ash, %	4.58
Moisture, %	1.91
Carbon Residue, %	60.76
Heat of Combustion:	
Gross, BTU/lb.	14,037
Net, BTU/lb.	13,523
Sulfur, %	1.00
Nitrogen, %	1.47
Oxygen, % (by difference)	7.84

Location 22
Unit 1
Test 42

Parts Per Million As Coal

	No. 3
Silicon	10,000
Iron	4,400
Aluminum	7,800
Magnesium	820
Calcium	1,900
Titanium	420
Barium	160
Boron	24
Manganese	23
Lead	40
Gallium	14
Tin	23
Nickel	11
Beryllium	0.9
Vanadium	0.3
Copper	22
Helium	500
Silver	10
Potassium	10
Zirconium	15
Cobalt	7.3
Strontium	100
Chromium	81

Respectfully submitted,

A. R. Briones

A.R. Briones
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No: [illegible] Test No: 93 Unit No: [illegible]

Unit Description: Titusville Boiler, Class A-[illegible]-017

Installation Date	1948
Steam Output (10^3 lb/hr)	10
Design Pressure (psig)	125
Final Steam Temp (°F)	350
Furnace Type	Firetube
Furnace Size L-W-H (ft)	
Furnace Area (ft^2)	
Furnace Volume (ft^3)	
Burner Description	1 Wiseler Underfeed Stoker
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	320

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Coal

Test No.	55:1						
Test Type	Base						
Test Load (10^3 lb/hr)	8						
Excess O_2 (%)	10						
NO_x (ppm)*	340						
NO (ppm)*	309						
$(O)_2$ dry (%)	8.0						
CO (ppm)*	1080						
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MMtu)	.078						
Solid Part. (lb/MMtu)	.03899						
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1800						
Final Stm Temp. (°F)	1000						
Combus. Air Temp. (°F)	Amb.						
Stack Temp. (°F)	320						
Fuel Flow							
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Registes (% open)							

*at 3% O_2 dry

K V B ENGINEERING, INC.
17332 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-6020

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 6/5/74

SAMPLES: 2 Coal Samples *location 22 Unit 2 Test 43*

KVB CHARGE NO.: 6000

INVESTIGATION: As Requested

RECEIVED: 7/16/74

ANALYZED: 7/24/74

LABORATORY NO: 74121-C

Sample Identification:

No. 2 Tests No. 42 and 43; Unit 1 and 2, 6/3/74

	No. 2
Carbon, %	77.09
Hydrogen, %	5.61
Ash, %	4.58
Moisture, %	1.91
Carbon Residue, %	60.76
Heat of Combustion:	
Gross, BTU/lb.	14,037
Net, BTU/lb.	13,585
Sulfur, %	1.50
Nitrogen, %	1.47
Oxygen, % (by difference)	7.84

Locality of Unit 2 Test 48

Parts Per Million in Coal

	No. 2
Silicon	16,000
Iron	4,400
Aluminum	7,000
Magnesium	800
Calcium	1,900
Titanium	420
Barium	140
Boron	24
Manganese	63
Lead	60
Gallium	16
Tin	73
Nickel	11
Beryllium	0.9
Vanadium	9.8
Copper	22
Sodium	300
Silver	0.0
Potassium	0.0
Zirconium	15
Cobalt	7.3
Strontium	100
Chromium	31

Respectfully submitted,

A. R. Briggs

A.R. Briggs
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 16 Test No. 39 Unit No. 1

Unit Description Kewanee Scotch Package Boiler

Installation Date	1969
Steam Output (10^3 lb/hr)	1
Design Pressure (psig)	100
Final Steam Temp (°F)	250 Max.
Furnace Type	Firetube
Furnace Dim L-W-H (ft)	20 - 9
Furnace Area (ft^2)	60
Furnace Volume (ft^3)	31
Burner Description	1 Kewanee Air Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	250
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	500

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL RUN DATA

Location [illegible]

Unit 1

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_R (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_R (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]						[illegible]
Stack Temp. (°F)							
Fuel Flow (#/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL, NOW DATA

Location [illegible]

Unit 1

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]			
Test Type	[illegible]	[illegible]	[illegible]	[illegible]			
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]			
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]			
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]			
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]			
SO_x (ppm)*				[illegible]			
SO_2 (ppm)*				[illegible]			
Total Part. (lb/MBtu)				[illegible]			
Solid Part. (lb/MBtu)				[illegible]			
Boiler Efficiency (%)				[illegible]			
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]			
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]			
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Combus. Air Temp. (°F)	[illegible]			[illegible]			
Stack Temp. (°F)				[illegible]			
Fuel Flow (lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]			
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

Fig. 2

K V B ENGINEERING, INC.
17988 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8060

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 6/7/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000 location #18 ANALYZED: 7/26/74
Unit 1
INVESTIGATION: As Requested Test 34 LABORATORY NO: 74121-0

Sample Identification:

-No. 8 6-7-74, Test 34; No. 6 Oil

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

Location #3
Sheet 1
Page 34

KVB

The results of the spectrographic analysis of the ore are as follows:

Parts Per Million in Oil

	No. 2.
Vanadium	34.
Nickel	7.8
Iron	48.
Silicon	37.
Calcium	8.4
Aluminum	33.
Sodium	17.
Manganese	0.33
Barium	0.1
Magnesium	3.8
Lead	4.8
Chromium	0.095
Molybdenum	Trace
Tin	0.32
Copper	0.11
Silver	0.008
Zinc	1.6
Titanium	0.34
Cobalt	0.099
Strontium	0.38
Phosphorus	ND
Cadmium	ND

ND = not detected

(Continued)

KVB

Location 28
Unit 1
Test 34

	No. 2
Carbon, %	86.69
Hydrogen, %	10.70
Ash, %	0.038
Carbon Residue, %	11.06
Flash Point, °C	141
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	18,080
Net, Btu/lb	17,310
API Gravity	13.7 at 76°F
Nitrogen, %	.27
Sulfur, %	1.85
Viscosity SSU	514 at 151°F
Oxygen, %	.45

* The sample is too dark in color to determine the Aniline Point.

INDUSTRIAL BOILER DESIGN DATA

Location No. 25 Test No. 40 Unit No. 1

Unit Description Kewanee Scotch Package Boiler

Installation Date	1969
Steam Output (10^3 lb/hr)	7
Design Pressure (psig)	100
Final Steam Temp (°F)	350 Max
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20 - 9
Furnace Area (ft^2)	66
Furnace Volume (ft^3)	31
Burner Description	1 Kewanee Gas Ring Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL BOOM DATA

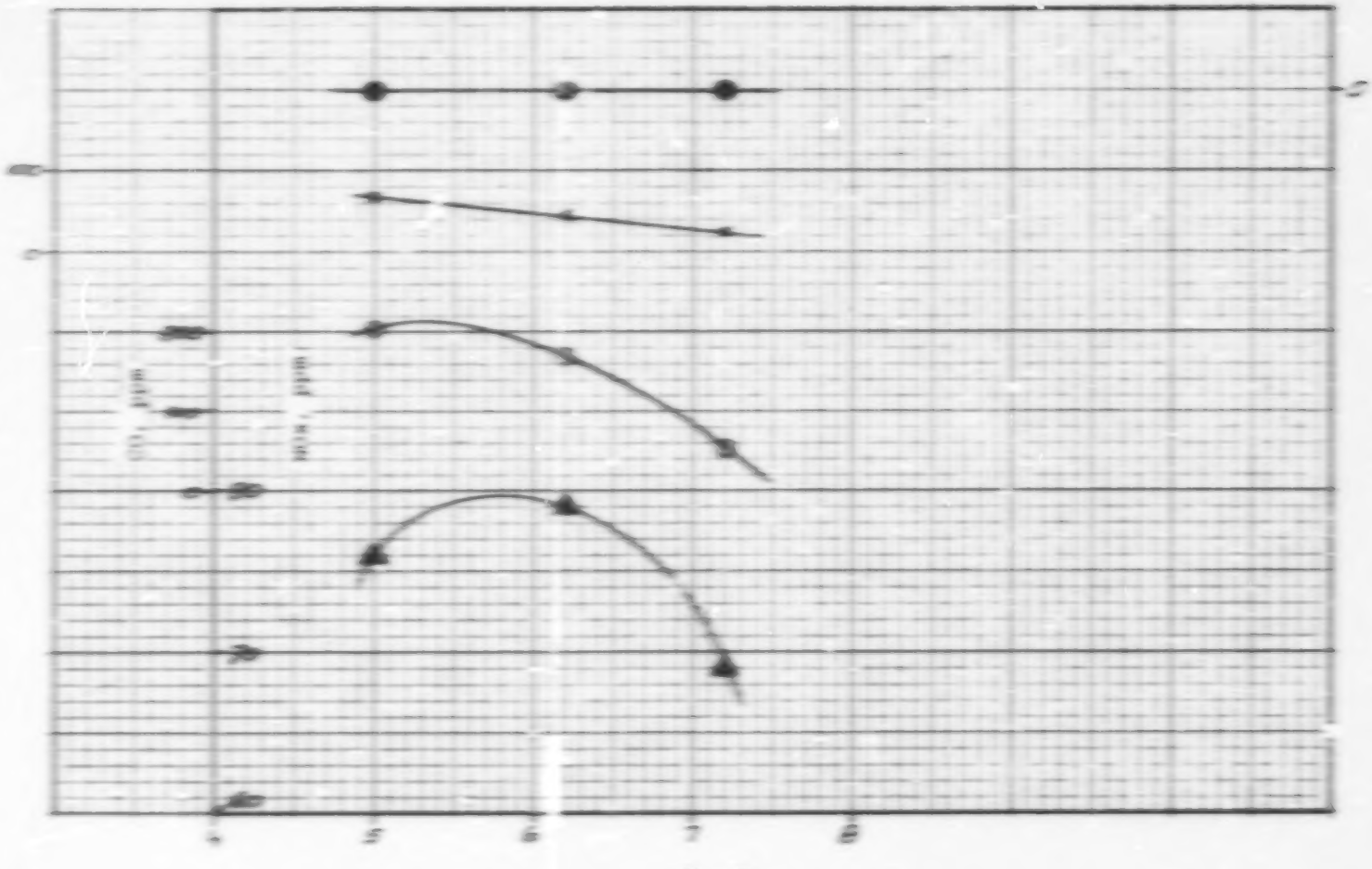
Location [illegible]

Unit 1

Fuel Natural Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test Type	Base	Hi Air	Hi Air	[illegible] Air	[illegible] Air	Low Excess	
Test Load (10^3 lb/hr)	6.1	6.1	6.1	6.1	5.9	2.0	
Excess O_2 (%)	5.0	7.2	9.2	5.0	8.8	10.5	
NO$_x$ (ppm)*	70	69	79	70	70	79	
NO (ppm)*	74	68	78	68	68	78	
CO$_2$ dry (%)	8.6	10	8.9	9.2	10	8	
CO (ppm)*	208	52	171	386	0	581	
HC (ppm)*	66	62	92	59	10	174	
SO$_x$ (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
SO$_2$ (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Smoke Spot No.	0	0	0	0	0	0	
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Final Stm Pres. (psig)	70	62	63	60	70	80	
Final Stm Temp. (°F)	177	285	290	288	290	285	
Combus. Air Temp. (°F)	Amb	[illegible]	[illegible]	[illegible]	[illegible]	"	
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Flow (ft^3/min)	129	128	128	128	68	99?	
Fuel Temp. (°F)	Amb	[illegible]	[illegible]	[illegible]	[illegible]	"	
Fuel Pres. (psig)	0.8	0.7	0.6	0.8	0.8	0.4	
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Registers (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

*at 3% O_2 dry



Emissions for Industrial Boilers as a Function of Excess Oxygen

Location 28
Unit 1
Test No. 40

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible] %	[illegible] %	[illegible] %	[illegible] %	[illegible] %	[illegible] BTU
6	.9	0	.1	99.0	10.0	1100
8	.9	0	.1	99.0	10.0	1100
10	.9	0	.1	99.0	10.0	1100
12	.9	0	.1	99.0	10.0	1100
14	0	.3	0.6	74.0	00.6	1109
16	0	.3	0.6	74.0	00.6	1109
18	0	.3	0.6	74.0	00.6	1109
20	.9	0	.1	99.0	10.0	1100
22	0	.3	0.6	74.0	00.6	1109
24	.9	0	.1	99.0	10.0	1100
26	.9	0	.1	99.0	10.0	1100
28	.8	.0	0.1	98.9	0.8	984
30	.9	0	0.9	99.0	0	986
32	.9	0	.1	99.0	10.0	1100
34	.9	0	0.9	99.0	0	986
36	.8	.0	0.1	98.9	0.8	984
38	.8	0	0.8	98.1	8.7	987
40	.9	0	.1	99.0	10.0	1100
42	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
44	.9	0	.1	99.0	10.0	1100
46	.9	0	.1	99.0	10.0	1100
48	0.9	0	1.0	88.0	99.7	1088
50	0.9	0	1.0	88.0	99.7	1088
52	0	.3	4.0	74.0	00.6	1109

INDUSTRIAL BOILER DESIGN DATA

Location No. 15 Test No. 51 Unit No. 1

Unit Description Kewanee Scotch Package Boiler

Installation Date	1969
Steam Output (10^3 lb/hr)	7
Design Pressure (psig)	100
Final Steam Temp (°F)	250 max.
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20 - 9
Furnace Area (ft^2)	66
Furnace Volume (ft^3)	31
Burner Description	1 Kewanee Air Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#5 oil
Fuel Temp at Burner (°F)	180
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel #6 Oil

Test No.	81-1						
Test Type	Base						
Test Load (10^3 lb/hr)	6.7						
Excess O_2 (%)	6.3						
NO_x (ppm)*	278						
NO (ppm)*	278						
$(O)_2$ dry (%)	11.2						
CO (ppm)*	0						
HC (ppm)*							
NO_x (ppm)*							
NO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.	0						
Opacity (%)							
Final Stm Pres. (psig)	19						
Final Stm Temp. (°F)	530						
Combus. Air Temp. (°F)	Amb						
Stack Temp. (°F)							
Fuel Flow (lb/hr)	602						
Fuel Temp. (°F)	180						
Fuel Pres. (psig)	40						
Furnace Pres. (in H_2O)							
Register (% open)							

*at 3% O_2 dry

K V B ENGINEERING, INC.
17332 IRVINE BLVD
TUSTIN, CALIFORNIA 92680
(714) 832-8000

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 8/1/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 74121-0

Sample Identification:

No. 3 6-10-74, Test 01

No. 5 Oil

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

location of S
Unit 1
Test 51

KVB

	No. 3
Carbon, %	85.84
Hydrogen, %	10.23
Ash, %	0.029
Carbon Residue, %	6.35
Flash Point, °C	138
Aniline Point, °C	a
Heat of Combustion:	
Gross, Btu/lb	18,280
Net, Btu/lb	17,350
API Gravity	14.8 at 78°F
Nitrogen, %	.28
Sulfur, %	2.40
Viscosity SSU	212.3 at 105°F
Oxygen, %	1.22

a The sample is too dark in color to determine the Aniline Point.

Locations 23
Unit 1
Page 51

KVB

The results of the spectrographic analysis of the oils are as follows:

Parts Per Million in Oil

	No. 3
Vanadium	38.
Nickel	7.0
Iron	16.
Silicon	58.
Calcium	4.4
Aluminum	38.
Sodium	2.6
Manganese	0.23
Barium	1.7
Magnesium	2.6
Lead	7.0
Chromium	0.049
Molybdenum	ND
Tin	0.35
Copper	0.041
Silver	Trace
Zinc	0.72
Titanium	0.075
Cobalt	0.049
Strontium	0.15
Phosphorus	ND
Cadmium	ND

ND = not detected

(Continued)

INDUSTRIAL BOILER DESIGN DATA

Location No. 25 Test No. 69 Unit No. 1

Unit Description Kewanee Scotch Package Boiler

Installation Date	1969
Steam Output (10^3 lb/hr)	7
Design Pressure (psig)	100
Final Steam Temp (°F)	250 Max.
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20 - 9
Furnace Area (ft^2)	66
Furnace Volume (ft^3)	31
Burner Description	1 Kewanee Air Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 oil
Fuel Temp at Burner (°F)	85
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location C-3

Unit 1

Fuel #2 Oil

Test No.	69-1						
Test Type	Base						
Test Load (10^3 lb/hr)	6.7						
Excess O_2 (%)	4.8						
NO$_x$ (ppm)*	128						
NO (ppm)*	126						
CO_2 dry (%)	10.5						
CO (ppm)*	0						
HC (ppm)*							
SO$_x$ (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.	1						
Opacity (%)							
Final Stm Pres. (psig)	15						
Final Stm Temp. (°F)	370						
Combus. Air Temp. (°F)	Amb						
Stack Temp. (°F)							
Fuel Flow (lb/hr)	442						
Fuel Temp. (°F)	85						
Fuel Pres. (psig)	54						
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

K V B ENGINEERING, INC.
17800 IRVINE BLVD
TUSTIN, CALIFORNIA 92680
(714) 832-8020

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 8/1/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 7412I-0

Sample Identification:

No. 8 Test [illegible]

No. 2 Oil

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

Location 38
Unit 1
Test 64

KVB

	No. 6
Nitrogen, %	.015
Sulfur, %	.38
Carbon, %	87.07
Hydrogen, %	11.87
Ash, %	0.003
Carbon Residue, %	0.35
Flash Point, °C	91
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	19,190
Net, Btu/lb	18,310
Oxygen, %	.66
API Gravity	15.1 at 76°F
Viscosity SSU	98.0 at 104

* The sample is too dark in color to determine the Aniline Point.

KVB

Location #3
Unit 1
Test #4

Parts per Million (p.p.m.)

	No. 8
Vanadium	2.8
Nickel	1.7
Iron	1.8
Silicon	1.7
Calcium	0.34
Aluminum	0.78
Sodium	ND
Manganese	0.051
Magnesium	0.15
Lead	1.1
Chromium	Trace
Tin	0.34
Copper	0.20
Silver	ND
Titanium	0.049
Strontium	ND
Lanthanum	ND
Zinc	1.7
Cadmium	Trace

* There was insufficient ash for a spectrographic analysis.

ND = not detected

Respectfully submitted,

A.R. Briones

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A.R. Briones
Laboratory Director

INDUSTRIAL BOILER CHECK CARD

Location No. 20 Test No. 66 Unit No. IV

Unit Description Firetube Boiler

Installation Date	1969
Steam Output (10^3 lb/hr)	10.6
Design Pressure (psig)	
Final Steam Temp (°F)	
Furnace Type	Firetube
Furnace Size L-W-H (ft)	
Furnace Area (ft^2)	
Furnace Volume (ft^3)	
Burner Description	1 Industrial Combustion Air Atom Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	190
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL NOW DATA

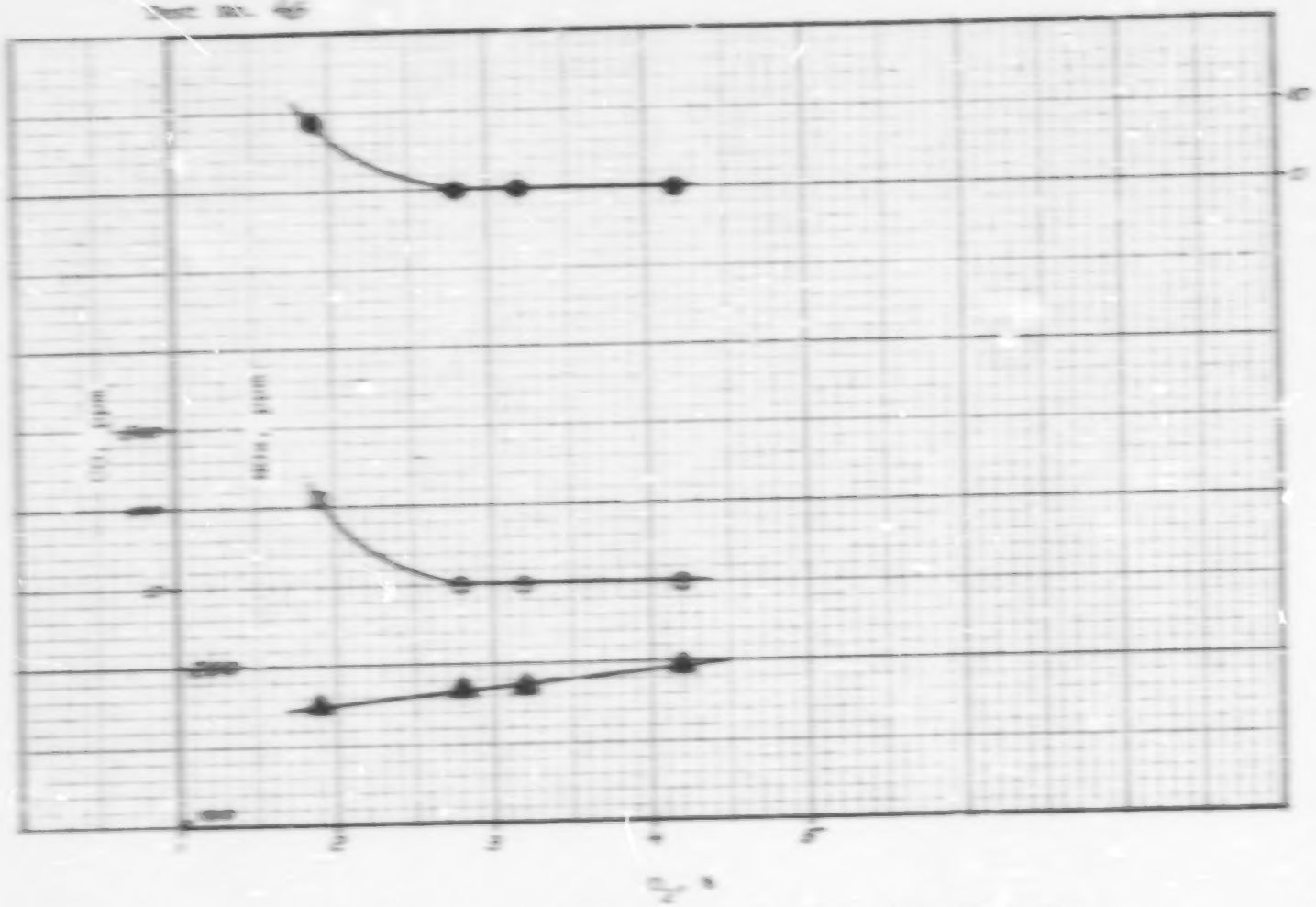
Location [illegible]

Unit FV

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
UHC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NH (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_Δ (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Press (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Registers (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry



Emissions for Industrial Boilers as a Function of Excess Oxygen

K V B ENGINEERING, INC.
17332 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8020

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 8/1/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000 (Excelsior #4 Unit IV)

ANALYZED: 7/25/74

INVESTIGATION: As Requested (Test 46)

LABORATORY NO: 74121-0

Sample Identification:

No. 4 5-14-74, Test 46;
No. 5 Oil

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

location 24
Unit IV
Test 46

KVB

	No. 6
Carbon, %	85.14
Hydrogen, %	11.21
Ash, %	0.26
Carbon Residue, %	5.36
Flash Point, °C	136
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	18,760
Net, Btu/lb	17,730
API Gravity	22.4 at 77°F
Nitrogen, %	.20
Sulfur, %	1.30
Viscosity SSU	90.0 at 104°
Oxygen, %	1.91

* The sample is too dark in color to determine the Aniline Point.

Condition 24
Sheet IV
1000 gal

KVB

The results of the spectrographic analysis of the oils are as follows:

Parts Per Million in Oil

	No. 4
Vanadium	29.
Nickel	8.6
Iron	94.
Silicon	8.6
Calcium	440.
Aluminum	8.3
Sodium	ND
Manganese	2.9
Barium	53.
Magnesium	78.
Lead	750.
Chromium	6.2
Molybdenum	0.81
Tin	1.8
Copper	2.0
Silver	ND
Zinc	170.
Titanium	ND
Cobalt	Trace
Strontium	2.0
Phosphorus	800
Cadmium	Trace

ND = not detected

(Continued)

INDUSTRIAL BOILER DESIGN DATA

Location No. 24 Test No. 67 Unit No. IV

Unit Description Firesville Boiler

Installation Date	1960
Steam Output (10^3 lb/hr)	10.6
Design Pressure (psig)	
Final Steam Temp (°F)	
Furnace Type	Firetube
Furnace Size L-W-H (ft)	
Furnace Area (ft^2)	
Furnace Volume (ft^3)	
Burner Description	1 Industrial combustion Eng. Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL RKM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)	[illegible]						"
Stack Temp. (°F)							
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]						"
Fuel Pres. (psig)			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]				[illegible]	[illegible]
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL NOX DATA

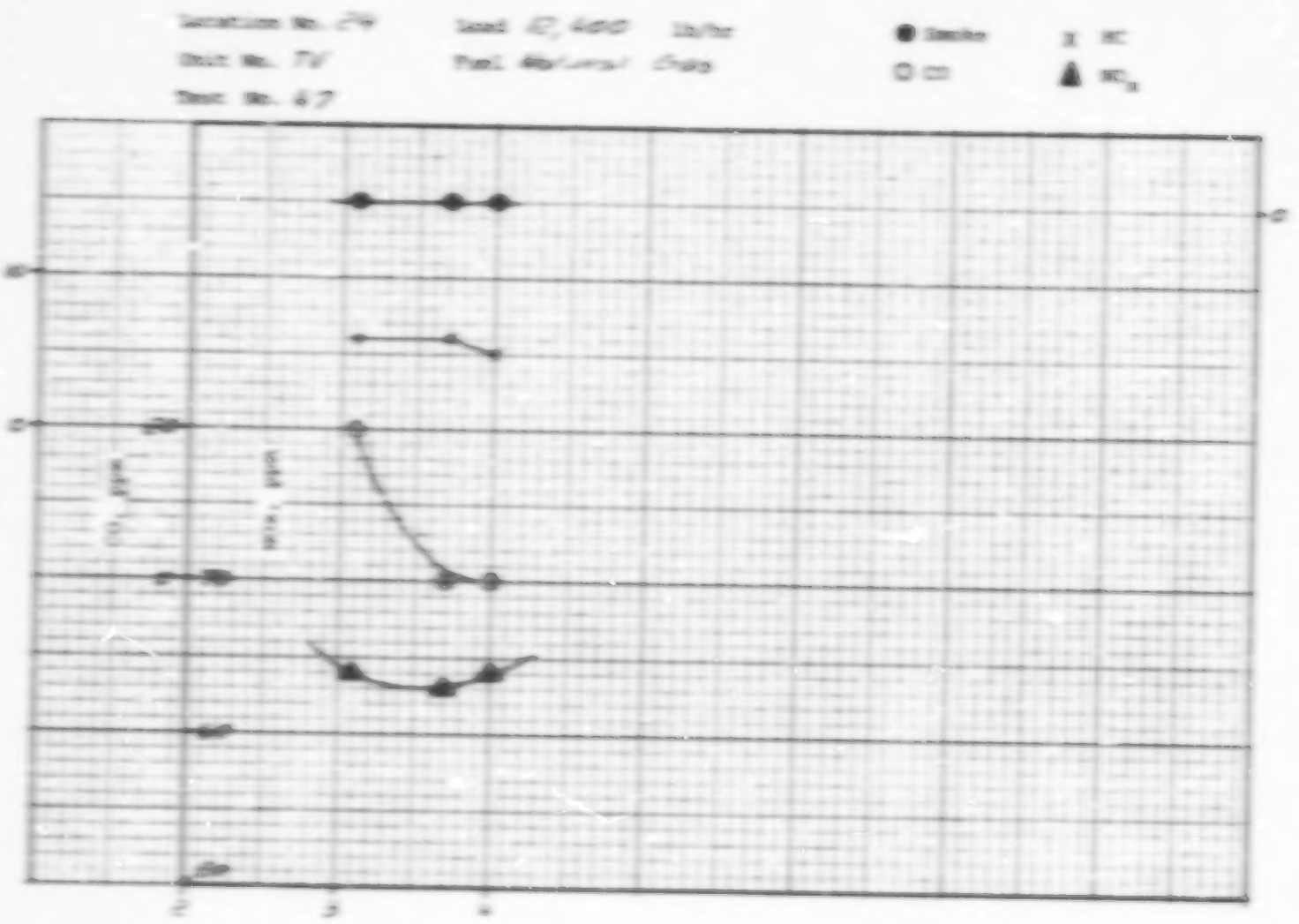
Location CV

Unit 7V

Fuel Natural Gas

Test No.	07 08						
Test Type	M Avg						
Test load (10^3 lb/hr)	420						
Excess O_2 (%)	4.0						
NO_x (ppm)[a]	64						
NO (ppm)[a]	60						
CO_2 dry (%)	9.4						
CO (ppm)[a]	0						
HC (ppm)[a]	5						
SO_x (ppm)[a]							
SO_2 (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.	0						
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)	Amb						
Stack Temp. (°F)							
Fuel Flow $CF^3/Hr \times 10^3$	15.0						
Fuel Temp. (°F)	Amb						
Fuel Pres. (psig)	5.9						
Furnace Pres. (in. H_2O)	0.2						
Register (% open)							

[a] at 3% O_2 dry

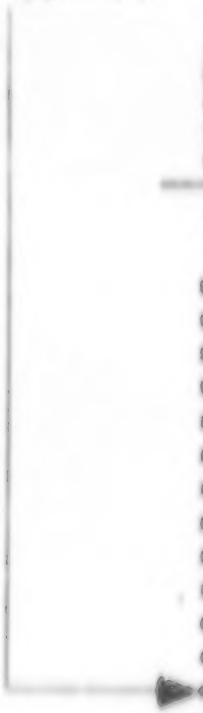


Emissions for Industrial Boilers as a Function of Excess Oxygen

Location 24
Unit IV
Test No. 47

FUEL ANALYSIS SUMMARY

Gas Fuel



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
46	.0	0	.1	85.0	14.9	1148
9	.0	0	.1	85.0	14.9	1148
50	.0	0	.1	85.0	14.9	1148
51	.0	0	.1	85.0	14.9	1148
52	0	.0	0.0	74.0	25.0	1139
53	0	.0	0.0	74.0	25.0	1139
54	0	.0	0.0	74.0	25.0	1139
55	.0	0	.1	85.0	14.9	1148
56	0	.0	0.0	74.0	25.0	1139
57	.0	0	.1	85.0	14.9	1148
58	.0	0	.1	85.0	14.9	1148
59	.0	.0	0.0	99.9	0.0	994
60	.0	0	0.0	99.9	0	994
61	.0	0	.1	85.0	14.9	1148
62	.0	0	0.0	99.9	0	994
63	.0	.0	0.0	99.9	0.0	994
64	.0	0	0.0	94.1	5.9	987
65	.0	0	.1	85.0	14.9	1148
66	.0	0	.1	85.0	14.9	1148
67	.0	0	.1	85.0	14.9	1148
68	.0	0	.1	85.0	14.9	1148
75	0.1	0	1.1	83.6	99.7	1168
77	0.0	0	1.0	83.6	99.7	1168
80	0	.0	0.0	74.0	25.0	1139

INDUSTRIAL BOILER DESIGN DATA

Location No. 20 Test No. 73 Unit No. 1V

Unit Description Firetube Boiler

Installation Date	1960
Steam Output (10^3 lb/hr)	10.6
Design Pressure (psig)	
Final Steam Temp (°F)	
Furnace Type	Firetube
Furnace Size L-W-H (ft)	
Furnace Area (ft^2)	
Furnace Volume (ft^3)	
Burner Description	1 Industrial Combust. Air Atom. Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Residual
Fuel Temp at Burner (°F)	80 @ 1
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	

Comments:

BOILER EMISSION MEASUREMENTS

AND CONTROL NOW DATA

Location C-9

Unit FV

Fuel #2 Oil

Test No.	73-1						
Test Type	Base						
Test Load (10^3 lb/hr)	//						
Excess O_2 (%)	3.1						
NO_x (ppm)*	60						
NO (ppm)*	59						
$(\%)_2$ dry (%)	427						
CO (ppm)*	0						
HC (ppm)*							
SO_2 (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)	Ambient						
Stack Temp. (°F)							
Fuel Flow (lbs/hr)	1900						
Fuel Temp. (°F)	Ambient						
Fuel Pres. (psig)	80						
Furnace Pres. (in H_2O)							
Register (% open)							

*at 3% O_2 dry

K V B ENGINEERING, INC.
[illegible] IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) [illegible]

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA

Attn: G. Cota

DATE: 8/1/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000

Location of Unit IV Test 78

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 74121-8

Sample Identifications:

← No. 1 0-17-74, Test #8 ; No. 2 Oil

→ SEE FOLLOWING PAGE FOR SAMPLE RESULTS

Location #6
Unit IV
Test 78

KVB

	No. 5
Nitrogen, %	.015
Sulfur, %	.19
Carbon, %	86.62
Hydrogen, %	12.75
Ash, %	< 0.001
Carbon Residue, %	0.017
Flash Point, °C	104
Aniline Point, °C	60.6
Heat of Combustion:	
Gross, Btu/lb	19,110
Net, Btu/lb	18,101
Oxygen, %	.225
API Gravity	37.0 at 78°F
Viscosity SSU	36.0 at 100°F

* The sample is too dark in color to determine the Aniline Point.

KVB

Location [illegible]
Unit IV
Year 73

Parts Per Million As Ni

	No. 3
[illegible]	*
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	

* Sheen was insufficient with dew = spectrographic analysis.

MD - not detected

Respectfully submitted,

A R Brenya

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A. R. Brenya
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 05 Test No. 09 Unit No. 1

Unit Description Cleaver Brooks Packaged Boiler

Installation Date	1968
Steam Output (10^3 lb/hr)	20
Design Pressure (psig)	150
Final Steam Temp (°F)	365
Furnace Type	Firetube
Furnace Size L-W-H (ft)	
Furnace Area (ft^2)	
Furnace Volume (ft^3)	
Burner Description	1 Cleaver Brooks Gas Ring
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	~ 350

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL SYSTEM DATA

Location [illegible]
Unit 1
Fuel Natural Gas

Test No.	44	44-1 Normal Air	44-3 Low Load	44-4 Normal Air	44-5 H Air	44-6 H Air
Test Type	Base					
Test Load (10^3 lb/hr)	12.5	6.5	4.0	12.5	12.5	12.5
Excess O_2 (%)	2.0	2.7	3.5	2.0	3.5	4.0
NO_x (ppm)*	84	82	13	82	91	86
NO (ppm)*	80	82	70	81	88	82
CO_2 dry (%)	10	10.1	9.7	10	9.7	9.5
CO (ppm)*	139	100	10.2	139	10	21
HC (ppm)*	681	982	395	691	673	1150
SO_x (ppm)*						
SO_2 (ppm)*						
Total Part. (lb/MBtu)						
Solid Part. (lb/MBtu)						
Boiler Efficiency (%)	83		85			81
Smoke Spot No.						
Opacity (%)						
Final Stm Pres. (psig)	14	14	14	14	14	14
Final Stm Temp. (°F)	350	350	350	350	350	350
Combus. Air Temp. (°F)	Amb					"
Stack Temp. (°F)	350	300	275	350	360	370
Fuel Flow (ft³/Hr)	5490					
Fuel Temp. (°F)	Amb					"
Fuel Pres. (psig)						
Furnace Pres. (in. H_2O)						
Register (% open)						

*as is O_2 dry

Emissions for Industrial Boilers as a Function of Excess Oxygen

Cincinnati Gas & Electric Co.
Unit 1
Test No. 49

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.9	0	.1	86.9	13.0	1160
5	.9	0	.1	86.9	13.0	1160
10	.9	0	.1	86.9	13.0	1160
11	.9	0	.1	86.9	13.0	1160
14	0	.3	4.6	74.0	20.6	1139
15	0	.3	4.6	74.0	20.6	1139
24	0	.3	4.6	74.0	20.6	1139
25	.9	0	.1	86.9	13.0	1160
30	0	.3	4.6	74.0	20.6	1139
37	.9	0	.1	86.9	13.0	1160
38	.9	0	.1	86.9	13.0	1160
39	.8	.6	6.3	88.9	3.4	966
40	.5	0	3.9	95.6	0	966
41	.9	0	.1	86.9	13.0	1160
47	.5	0	3.9	95.6	0	966
48	.8	.6	6.3	88.9	3.4	966
49	.6	0	6.4	94.1	5.7	967
58	.9	0	.1	86.9	13.0	1160
60	.9	0	.1	86.9	13.0	1160
67	.9	0	.1	86.9	13.0	1160
68	.9	0	.1	86.9	13.0	1160
76	3.5	0	1.3	27.6	69.7	1340
77	3.5	0	1.3	27.6	69.7	1340
80	0	.3	4.6	74.0	20.6	1139

INDUSTRIAL BOILER DESIGN DATA

Location No. 26 Test No. 35 Unit No. 2

Unit Description Firetube Boiler, Model PBAL-40-A

Installation Date	1970
Steam Output (10^3 lb/hr)	11
Design Pressure (psig)	15
Final Steam Temp (°F)	350
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20-10
Furnace Area (ft^2)	13
Furnace Volume (ft^3)	34
Burner Description	1 Peabody Air Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#5 Oil
Fuel Temp at Burner (°F)	170
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	330

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL RUN DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Flow (GPH)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

*at 3% O_2 dry

K V B ENGINEERING, INC.
17964 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 838-8660

CHEMICAL LABORATORY REPORT

DATE: 8/1/74

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cain

SAMPLES: 8 Fuel Oil Samples

KVB CHARGE NO.: 6000

INVESTIGATION: As Requested

Location of End of Test 36

RECEIVED: 7/16/74

ANALYZED: 7/26/74

LABORATORY NO: 74121-6

Sample Identification:

No. 5 Oil

No. 6 6-24-74, Test 35

SEE FOLLOWING PAGE FOR SAMPLE RESULTS

KVB

	No. 5
Nitrogen, %	.025
Sulfur, %	1.46
Carbon, %	87.67
Hydrogen, %	9.61
Ash, %	0.007
Carbon Residue, %	3.79
Flash Point, °C	129
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	18,800
Net, Btu/lb	17,330
Oxygen, %	1.31
API Gravity	13.2 at 77°F
Viscosity SSU	87.0 at 104°F

* The sample is too dark in color to determine the Aniline Point.

KVB

Samples #6
Wed. 8
Test 35

Parts Per Million As Oil

	No. 5	No. 6	No. 7
Vanadium	*	1.4	*
Nickel		0.51	
Iron		2.9	
Silicon		21.	
Calcium		1.4	
Aluminum		6.4	
Sodium		0.68	
Manganese		0.062	
Magnesium		0.11	
Lead		0.17	
Chromium		0.045	
Tin		0.70	
Copper		0.014	
Silver		0.005	
Titanium		0.10	
Strontium		0.059	
Lanthanum		0.70	
Zinc		ND	
Cadmium		ND	

* There was insufficient ash for a spectrographic analysis.

ND = not detected

Respectfully submitted,

A.R. Brienza

474 A.R. Brienza
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 26 Test No. 39 Unit No. 2

Unit Description Frank Boiler, Model PBAL-48-A

Installation Date	1970
Steam Output (10^3 lb/hr)	11
Design Pressure (psig)	15
Final Steam Temp (°F)	250
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20-10
Furnace Area (ft^2)	73
Furnace Volume (ft^3)	34
Burner Description	1 Peabody Ring Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	360

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Natural Gas

Test No.	27:1	27:2	27:3	27:4			
Test Type	Base	Excess Air	Low Load	Low Air			
Test Load (10^3 lb/hr)	10.4	5.2	2.8	10.4			
Excess O_2 (%)	3.6	10.0	5.8	3.7			
NO_x (ppm)*	74	58	65	75			
NO (ppm)*	70	55	62	71			
CO_2 dry (%)	10.1	7.4	7.1	10.0			
CO (ppm)*	155	0	0	410			
HC (ppm)*	------	36	------	------			
SO_x (ppm)*	------	------	------	------			
SO_2 (ppm)*	------	------	------	------			
Total Part. (lb/MBtu)	------	------	------	------			
Solid Part. (lb/MBtu)	------	------	------	------			
Boiler Efficiency (%)	83	------	85	85			
Smoke Spot No.	------	------	------	------			
Opacity (%)	------	------	------	------			
Final Stm Pres. (psig)	8.0	5.0	1.0	8.5			
Final Stm Temp. (°F)	Sat'd.	------	------	►			
Combus. Air Temp. (°F)	Amb.	------	------	►			
Stack Temp. (°F)	350	300	290	350			
Fuel Flow (CFH)	42970	50897	31004	42970			
Fuel Temp. (°F)	Amb.	------	------	►			
Fuel Pres. (psig) "H2O	11	5.5	1.3	10.9			
Furnace Pres. (in. H_2O)	-0.05	0.10	0.00	-0.04			
Register (% open)	------	------	------	------			

*at 3% O_2 dry

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	85.8	13.9	1108
5	.0	0	.1	85.8	13.8	1108
12	.0	0	.1	85.8	13.8	1108
13	.0	0	.1	85.8	13.8	1108
14	0	.0	6.6	74.0	20.6	1129
15	0	.0	6.6	74.0	20.6	1129
24	0	.0	6.6	74.0	20.6	1129
25	.0	0	.1	85.1	13.8	1108
26	0	.0	6.6	74.0	20.6	1129
27	.0	0	.1	85.8	13.8	1108
28	.0	0	.1	85.8	13.8	1108
29	.0	.0	6.1	88.9	3.4	984
40	.0	0	3.9	96.6	0	964
41	.0	0	.1	85.8	13.8	1108
47	.0	0	3.9	96.6	0	966
48	.0	.0	6.3	88.8	3.4	984
49	.0	0	8.4	84.1	6.7	967
58	.0	0	.1	85.8	13.8	1109
60	.0	0	.1	85.8	13.8	1108
67	.0	0	.1	85.8	13.8	1108
69	.0	0	.1	85.8	13.8	1108
75	0.0	0	1.1	99.6	69.7	1048
77	0.0	0	1.1	99.6	69.7	1048
80	0	.0	6.6	74.0	20.6	1129

INDUSTRIAL BOILER DESIGN DATA

Location No. 06 Test No. 04 Unit No. 1

Unit Description Burnham 3 Pass Furnace

Installation Date	1971
Steam Output (10^3 lb/hr)	10
Design Pressure (psig)	15
Final Steam Temp (°F)	250
Furnace Type	Firetube
Furnace Size L-W-H (ft)	30 - 10
Furnace Area (ft^2)	208
Furnace Volume (ft^3)	163
Burner Description	1 Peabody Air Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	180
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	320

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(x)_d$ dry (x)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*							
SO_x (ppm)*							[illegible]
SO_2 (ppm)*							[illegible]
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	[illegible]		[illegible]	[illegible]		[illegible]	
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]						
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (GPH)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Register (% open)							

*at x% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

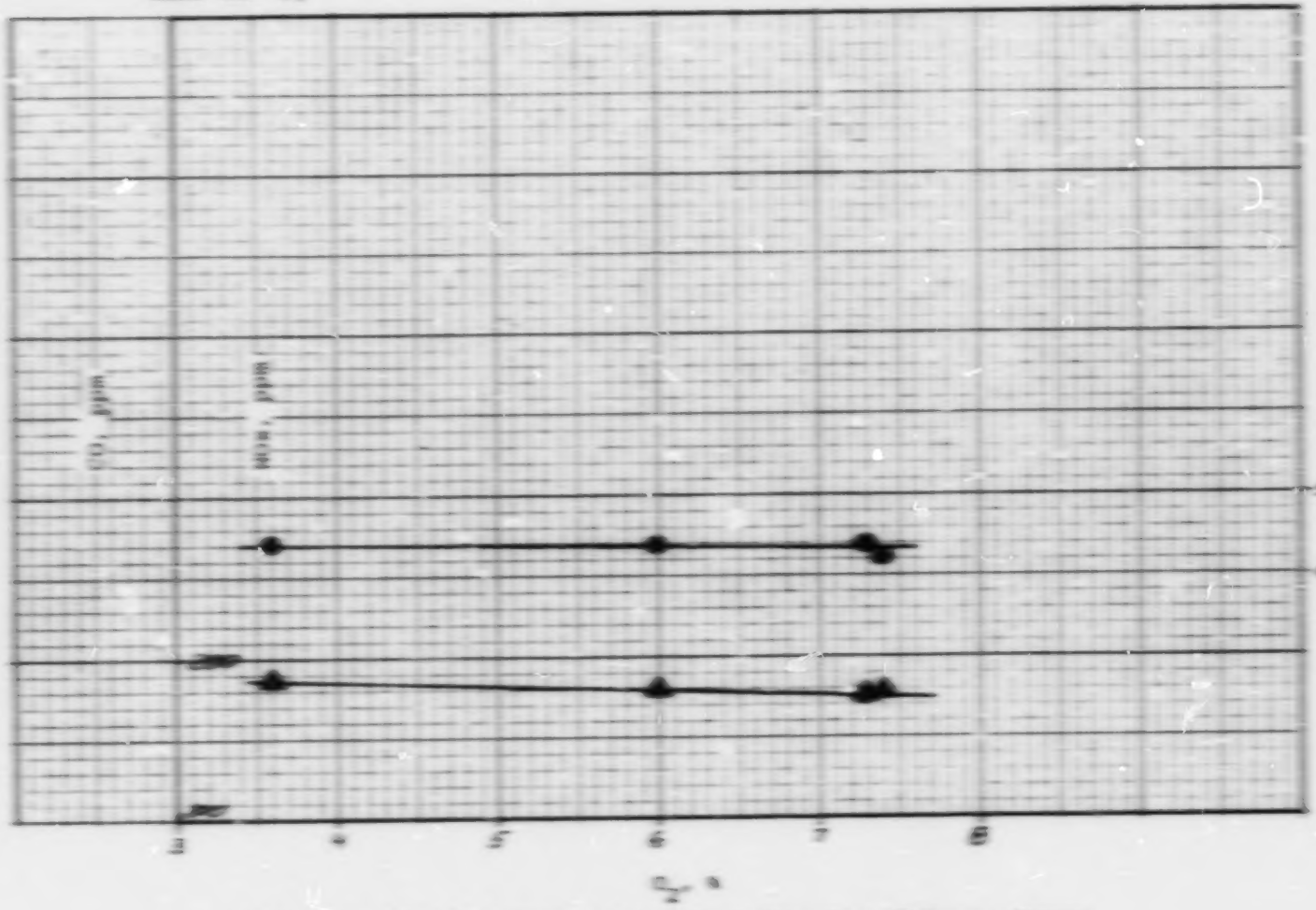
Location [illegible]

Unit 1

Fuel [illegible]

Test No.	[illegible]						
Test Type	[illegible]						
Test Load (10^3 lb/hr)	[illegible]						
Excess O_2 (%)	[illegible]						
NO_x (ppm)*	[illegible]						
NO (ppm)*	[illegible]						
$(O)_2$ dry (%)	[illegible]						
CO (ppm)*	[illegible]						
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)	[illegible]						
Solid Part. (lb/MBtu)	[illegible]						
Boiler Efficiency (%)							
Smoke Spot No.	[illegible]						
Opacity (%)							
Final Stm Pres. (psig)	[illegible]						
Final Stm Temp. (°F)	[illegible]						
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]						
Fuel Flow (GPM)	[illegible]						
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)	[illegible]						
Furnace Pres. (in. H_2O)	[illegible]						
Register (% open)							

*at 3% O_2 dry



Relations for Industrial Boilers as a Function of Excess Oxygen

K V B ENGINEERING, INC.
[illegible] IRVINE BLVD.
TUSTIN, CALIFORNIA [illegible]
[illegible]

CHEMICAL LABORATORY REPORT

DATE: 8/1/74

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cate

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/15/74

KVB CHARGE NO.: 6000

Inspection for Specif / Test 20

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 74131-0

Sample Identification:

No. 6 6-24-74, Test 441

No. 5 Oil

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

Location 20
Unit 1
Test 44

KVB

	No. 6
Nitrogen, %	.025
Sulfur, %	1.46
Carbon, %	87.67
Hydrogen, %	9.61
Ash, %	0.007
Carbon Residue, %	3.79
Flash Point, °C	139
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	18,200
Net, Btu/lb	17,330
Oxygen, %	1.23
API Gravity	13.2 at 77°F
Viscosity hUU	87.0 at 104°F

* The sample is too dark in color to determine the Aniline Point.

KVB

Correction to Unit 1 1982 44

Parts Per Million in Oil

	No. 3	No. 4	No. 7
Vanadium	*	1.4	*
Nickel		0.31	
Iron		2.9	
Silicon		21.	
Calcium		1.4	
Aluminum		6.4	
Sodium		0.68	
Manganese		0.062	
Magnesium		0.11	
Lead		0.17	
Chromium		0.045	
Tin		0.70	
Copper		0.014	
Silver		0.005	
Titanium		0.10	
Strontium		0.059	
Lanthanum		0.70	
Zinc		ND	
Cadmium		ND	

* There was insufficient ash for a spectrographic analysis.

ND = not detected

Respectfully submitted,

A.R. Briensa

A.R. Briensa

INDUSTRIAL BOILER DESIGN DATA

Location No. 26 Test No. 65 Unit No. 1

Unit Description Cleaver Brooks Firetube

Installation Date	1971
Steam Output (10^3 lb/hr)	10
Design Pressure (psig)	15
Final Steam Temp (°F)	350
Furnace Type	Firetube
Furnace Size L-W-H (ft)	30 - 10
Furnace Area (ft^2)	200
Furnace Volume (ft^3)	163
Burner Description	Pressure Steam Atom. Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	165
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	350

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (GPH)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

Backward Smoke No.

NO, ppm

CO, ppm

Emissions for Industrial Boilers as a Function of Excess Oxygen

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 8/1/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000

Locations of Wells 1 Test #3"

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 74131-0

Sample Identification:

No. 6 6-24-74, Test #3

No. 5 Oil

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

Deception #6
Unit 1
Test #5

KVB

	No. 6
Nitrogen, %	.035
Sulfur, %	1.46
Carbon, %	87.67
Hydrogen, %	9.61
Ash, %	0.007
Carbon Residue, %	3.79
Flash Point, °C	139
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	18,300
Net, Btu/lb	17,330
Oxygen, %	1.23
API Gravity	13.2 at 77°F
Viscosity SSU	87.0 at 104°F

* The sample is too dark in color to determine the Aniline Point.

Comparison of Used Fuel Oil

Parts Per Million in Oil

	No. 1	No. 5	No. 2
Vanadium	*	1.4	*
Nickel		0.31	
Iron		2.9	
Silicon		21.	
Calcium		1.4	
Aluminum		6.4	
Sodium		0.68	
Manganese		0.062	
Magnesium		0.11	
Lead		0.17	
Chromium		0.045	
Tin		0.70	
Copper		0.014	
Silver		0.005	
Titanium		0.10	
Strontium		0.039	
Lanthanum		0.70	
Zinc		ND	
Cadmium		ND	

* There was insufficient ash for a spectrographic analysis.

ND = not detected

Respectfully submitted,

A.R. Briones

A.R. Briones
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No: 66 Test No: 68 Unit No: 1

Unit Description: Burnham 3 Pass Furnace

Installation Date	1971
Steam Output (10^3 lb/hr)	18
Design Pressure (psig)	15
Final Steam Temp (°F)	250
Furnace Type	Firetube
Furnace Size L-W-H (ft)	30 - 10
Furnace Area (ft^2)	200
Furnace Volume (ft^3)	100
Burner Description	1 Peabody Ring Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	300

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

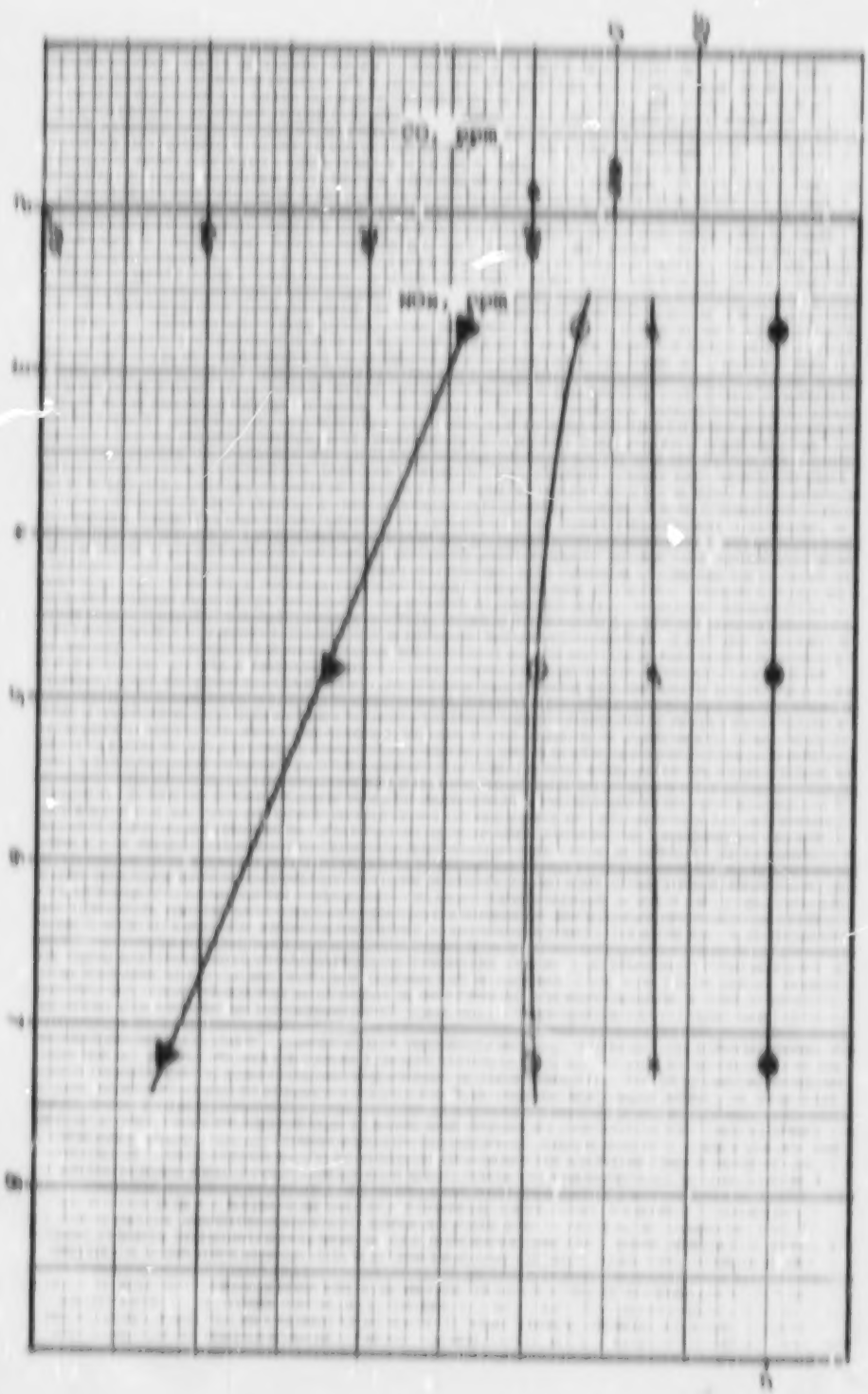
Location [illegible]

Unit 1

Fuel Natural Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test Type	Hi Load	Normal Air	Normal Air	Base	Low Air	Low Air	
Test load (10^3 lb/hr)	[illegible]	15.3	7.7	12.2	12.2	12.2	
Excess O_2 (%)	4.3	8.3	8.6	7.2	9.8	11.7	
NO_x (ppm)*	74	58	54	58	68	76	
NO (ppm)*	71	53	54	57	68	75	
CO_2 dry (%)	9.6	7.2	7.1	7.7	9.2	10.4	
CO (ppm)*	32	14	15	13	11	57	
HC (ppm)*	45	24	27	30	26	23	
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	82		83	82		84	
Smoke Spot No.	0	0	0	0	0	0	
Opacity (%)							
Final Stm Pres. (psig)	90	91.5	92.5	91.2	91.5	91	
Final Stm Temp. (°F)	Saturated					"	
Combus. Air Temp. (°F)	Ambient					"	
Stack Temp. (°F)	350	300	290	300	320	300	
Fuel Flow (cfh/sqft)	29	16.85	8.92	12.0	12.0	12.0	
Fuel Temp. (°F)	Ambient					"	
Fuel Pres. (psig) Mcf	10	10.7	21.0	12.7	12.0	11.9	
Furnace Pres. (in. H_2O)	0.1	1.0	0.9	1.9	0.8	0.48	
Register (% open)							

*at 3% O_2 dry


NO, ppm
CO, ppm
Bacharach Smoke No.

Location #6
Coal 1
Test No. 48

FUEL ANALYSIS SUMMARY

Gas Fuel

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.0	0	.1	85.0	13.0	1100
9	.0	0	.1	85.0	13.0	1100
10	.0	0	.1	85.0	13.0	1100
13	.0	0	.1	85.0	13.0	1100
14	0	.5	4.0	74.0	20.0	1120
15	0	.5	4.0	74.0	20.0	1120
24	0	.5	4.0	74.0	20.0	1120
25	.0	0	.1	85.0	13.0	1100
30	0	.5	4.0	74.0	20.0	1120
37	.0	0	.1	85.0	13.0	1100
38	.0	0	.1	85.0	13.0	1100
39	.4	.6	0.1	88.9	1.0	984
40	.6	0	3.0	96.4	0	966
41	.0	0	.1	86.8	13.0	1100
47	.0	0	3.0	96.0	0	960
48	.0	.6	0.3	88.9	1.0	984
49	.0	0	0.4	84.1	6.7	967
56	.0	0	.1	85.0	13.0	1100
60	.0	0	.1	85.0	13.0	1100
67	.0	0	.1	85.0	13.0	1100
69	.0	0	.1	85.0	13.0	1100
76	0.0	0	1.0	93.0	66.7	1140
77	0.0	0	1.0	93.0	66.7	1140
80	0	.0	4.0	74.0	20.0	1120

INDUSTRIAL BOILER DESIGN DATA

Location No. 26 Test No. 56 Unit No. 2

Unit Description Frank Boiler, Model PBAL-48-A

Installation Date	1970
Steam Output (10^3 lb/hr)	11
Design Pressure (psig)	15
Final Steam Temp (°F)	360
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20-10
Furnace Area (ft^2)	13
Furnace Volume (ft^3)	34
Burner Description	1 Peabody Air Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	385

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]						
Test Type	[illegible]						
Test Load (10^3 lb/hr)	[illegible]						
Excess O_2 (%)	[illegible]						
NO_x (ppm)*	[illegible]						
NO (ppm)*	[illegible]						
CO_2 dry (%)	[illegible]						
CO (ppm)*	[illegible]						
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	[illegible]						
Smoke Spot No.	[illegible]						
Opacity (%)							
Final Stm Pres. (psig)	[illegible]						
Final Stm Temp. (°F)	[illegible]						
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]						
Fuel Flow (GPH)	[illegible]						
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)	[illegible]						
Furnace Pres. (in. H_2O)	[illegible]						
Register (% open)							

*at 3% O_2 dry

K V B ENGINEERING, INC.
17332 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8020

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cate

DATE: 8/7/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000

Locations of Unit 2 Test 56

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 74121-0

Sample Identification:

No. 1 6-25-74, Tests 56 - 57, No. 2 Oil

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

location 26
Unit 2
Test 55

KVB

	No. 2
Nitrogen, %	.030
Sulfur, %	.48
Carbon, %	87.00
Hydrogen, %	11.90
Ash, %	< 0.001
Carbon Residue, %	0.16
Flash Point, °C	108
Aniline Point, °C	a
Heat of Combustion:	
Gross, Btu/lb	19,410
Net, Btu/lb	18,320
Oxygen, %	.60
API Gravity	35.5 at 75°F
Viscosity SSU	33.7 at 104°F

a The sample is too dark in color to determine the Aniline Point.

KVB

Location #6
Well #
Test 5'3"

Parts Per Million in Oil

	No. 1
Vanadium	*
Nickel	
Iron	
Silicon	
Calcium	
Aluminum	
Sodium	
Manganese	
Magnesium	
Lead	
Chromium	
Tin	
Copper	
Silver	
Titanium	
Strontium	
Lanthanum	
Zinc	
Uranium	

* There was insufficient ash for a spectrographic analysis.

ND - not detected

Respectfully submitted,

A.R. Briones

A.R. Briones
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 26 Test No. 56 Unit No. 1

Unit Description Burnham 3 Pass Furnace

Installation Date	1971
Steam Output (10^3 lb/hr)	10
Design Pressure (psig)	15
Final Steam Temp (°F)	250
Furnace Type	Firetube
Furnace Size L-W-H (ft)	30 - 10
Furnace Area (ft^2)	200
Furnace Volume (ft^3)	163
Burner Description	1 Peabody Air Atom. Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	310

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel [illegible]

Test No.	[illegible]						
Test Type	[illegible]						
Test Load (10^3 lb/hr)	[illegible]						
Excess O_2 (%)	[illegible]						
NO_x (ppm)*	[illegible]						
NO (ppm)*	[illegible]						
$(X)_2$ dry (%)	[illegible]						
CO (ppm)*	[illegible]						
HC (ppm)*	[illegible]						
SO_x (ppm)*	[illegible]						
SO_2 (ppm)*	[illegible]						
Total Part. (lb/MBtu)	[illegible]						
Solid Part. (lb/MBtu)	[illegible]						
Boiler Efficiency (%)	[illegible]						
Smoke Spot No.	[illegible]						
Opacity (%)	[illegible]						
Final Stm Pres. (psig)	[illegible]						
Final Stm Temp. (°F)	[illegible]						
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]						
Fuel Flow (103#/hr)	[illegible]						
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)	[illegible]						
Furnace Pres. (in. H_2O)	[illegible]						
Register (% open)	[illegible]						

*at 3% O_2 dry

K V B ENGINEERING, INC.
17332 IRVINE BLVD
TUSTIN, CALIFORNIA 92680
(714) 832-9000

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cate

DATE: 8/7/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/16/74

KVB CHARGE NO.: 6000 locations on Unit 1 Test 56

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 74121-0

Sample Identification:

No. 7 6-25-74, Tests 56 & 57, No. 2 Oil

SEE FOLLOWING PAGE FOR SAMPLE RESULTS

location #6
Unit 1
Test #6

KVB

	No. 2
Nitrogen, %	.030
Sulfur, %	.48
Carbon, %	87.00
Hydrogen, %	11.90
Ash, %	< 0.001
Carbon Residue, %	0.16
Flash Point, °C	108
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	19,410
Net, Btu/lb	18,320
Oxygen, %	.60
API Gravity	35.5 at 76°F
Viscosity SSU	33.7 at 104°F

* The sample is too dark in color to determine the Aniline Point.

Location 26
Unit 1
Test 56

Parts Per Million in Oil

	No. 1
Vanadium	*
Nickel	
Iron	
Silicon	
Calcium	
Aluminum	
Sodium	
Manganese	
Magnesium	
Lead	
Chromium	
Tin	
Copper	
Silver	
Titanium	
Strontium	
Lanthanum	
Zinc	
Cadmium	

* There was insufficient ash for a spectrographic analysis.

ND = not detected

Respectfully submitted,

A.R. Briones

A.R. Briones
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No. 26 Test No. 57 Unit No. 1

Unit Description: Burnham 3 Pass Furnace

Installation Date	1971
Steam Output (10^3 lb/hr)	10
Design Pressure (psig)	15
Final Steam Temp (°F)	350
Furnace Type	Firetube
Furnace Size L-W-H (ft)	20 - 10
Furnace Area (ft^2)	200
Furnace Volume (ft^3)	163
Burner Description	1 Peabody Steam Atom. Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	310

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location Pa

Unit 1

Fuel #2 Oil

Test No.	27-1						
Test Type	Base						
Test load (10^3 lb/hr)	15.7						
Excess O_2 (%)	2.0						
NO_x (ppm)*	118						
NO (ppm)*	116						
O_2 dry (%)	2.0						
CO (ppm)*	0						
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	86						
Smoke Spot No.	1.5						
Opacity (%)							
Final Stm Pres. (psig)	410						
Final Stm Temp. (°F)	Saturr.						
Combus. Air Temp. (°F)	Ambt.						
Stack Temp. (°F)	310						
Fuel Flow (GPH)	141						
Fuel Temp. (°F)	98						
Fuel Pres. (psig)	80						
Furnace Pres. (in. H_2O)	1.8						
Register (% open)							

*at 3% O_2 dry

K V B ENGINEERING, INC.
17332 IRVINE BLVD.
TUSTIN, CALIFORNIA 92680
(714) 832-8000

CHEMICAL LABORATORY REPORT

CLIENT: KVB, Inc.
Tustin, CA
Attn: G. Cato

DATE: 8/1/74

SAMPLES: 8 Fuel Oil Samples

RECEIVED: 7/15/74

KVB CHARGE NO.: 6000

location of Unit 7 Test SP

ANALYZED: 7/26/74

INVESTIGATION: As Requested

LABORATORY NO: 74131-0

Sample Identification:

No. 7 6-25-74, Tests 56 & 57, No. 2 Oil

SEE FOLLOWING PAGE
FOR SAMPLE RESULTS

location 20
Unit 1
Test 57

KVB

	No. 7
Nitrogen, %	.020
Sulfur, %	.48
Carbon, %	87.00
Hydrogen, %	11.90
Ash, %	< 0.001
Carbon Residue, %	0.15
Flash Point, °C	108
Aniline Point, °C	*
Heat of Combustion:	
Gross, Btu/lb	19,410
Net, Btu/lb	18,320
Oxygen, %	.60
API Gravity	35.5 at 76°F
Viscosity SSU	33.7 at 104°F

* The sample is too dark in color to determine the Aniline Point.

KVB

Corrections on
Work
Test

Parts Per Million : Oil

	No. 1
Vanadium	*
Nickel	
Iron	
Silicon	
Calcium	
Aluminum	
Sodium	
Manganese	
Magnesium	
Lead	
Chromium	
Tin	
Copper	
Silver	
Titanium	
Strontium	
Lanthinum	
Zinc	
Cadmium	

* There was insufficient ash for a spectrographic analysis.

ND - not detected

Respectfully submitted,

A.R. Briensa

509

A.R. Briensa
Laboratory Director

INDUSTRIAL BOILER DESIGN DATA

Location No: [illegible] Test No: 109-040 Unit No: 1

Unit Description B&W FM type, D style Furnace

Installation Date	1968 ?
Steam Output (10^3 lb/hr)	120
Design Pressure (psig)	150
Final Steam Temp (°F)	96 ?
Furnace Type	Watertube
Furnace Size L-W-H (ft)	21-6-9
Furnace Area (ft^2)	738
Furnace Volume (ft^3)	1134
Burner Description	1 Coen Ring Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	340

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location C.P.

Unit 1

Fuel Natural Gas

Test No.	NG-1	NG-2	NG-3	NG-4	NG-5	NG-6	NG-7
Test Type	Basic	Low Air	Low Air	Low Air	Normal Air	Normal Air	Normal Air
Test Load (10^3 lb/hr)	75	75	75	75	50	50	95
Excess O_2 (%)	6.6	5.0	3.9	1.3	6.9	6.5	6.1
NO_x (ppm)*	113	192	159	146	101	99	104
NO (ppm)*	111	137	156	145	100	96	102
CO_2 dry (%)	7.9	8.8	9.4	10.8	6.8	7.2	7.1
CO (ppm)*	0	0	21	164	0	0	0
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	82						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	129	128	125	128	130	128	127
Final Stm Temp. (°F)	Saturated						"
Combus. Air Temp. (°F)	Ambient						"
Stack Temp. (°F)							
Fuel Flow (CFH/MM#)	82	82	82	82			
Fuel Temp. (°F)	Ambient						"
Fuel Pres. (psig)	10	10	10	10			
Furnace Pres. (in. H_2O)	0.2	0.0	0.0	-0.1	0.0	0.0	0.0
Register (% open)	65 - 70	65 - 70	65 - 70	65 - 70	65 - 65	60 - 60	70 - 70

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel Natural Gas

Test No.	110-1	110-2	110-3				
Test Type	Bl. Tune	Bl. Tune	Bl. Tune				
Test Load (10^3 lb/hr)	78	67	53				
Excess O_2 (%)	4.4	3	3.9				
NO_x (ppm)*	157	194	199				
NO (ppm)*	151	141	141				
CO_2 dry (%)	9.3	10.2	8.3				
CO (ppm)*	0	55	0				
HC (ppm)*	16	13					
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	82						
Smoke Spot No.							
Opacity (%)							
Final Stm Press. (psig)	150	150	154				
Final Stm Temp. (°F)	Saturated	→	→				
Combus. Air Temp. (°F)	Ambient	→	→				
Stack Temp. (°F)							
Fuel Flow (CFM/$\times 10^3$	61	50	38				
Fuel Temp. (°F)	Ambient	→	→				
Fuel Press. (psig)	0.4	1.6	0.5				
Furnace Press. (in. H_2O)	0.2	0.8	1				
Register (% open)	75 - 75	65 - 65	40 - 40				

*at 3% O_2 dry

[illegible] FUEL ANALYSIS SUMMARY

Gas Fuel

Location 27
Unit 1
Test #6, 104 - 110

Test No.	Type of Gas	CH_4 %	C_2H_6 %	C_3H_8 %	C_4H_{10} %	C_5H_{12} %	C_6H_{14} %	N_2 %	CO_2 %	O_2 %	H_2 %	H.V. %	Gaseous Higher Heating Value (HHV) BTU/SCF	Gaseous Lower Heating Value (LHV) BTU/SCF	Other
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	–	–	–	[illegible]	–	[illegible]	–	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	–	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	–	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	–	–	–	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	–	–	–	[illegible]	[illegible]	–	–	–	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	–	[illegible]	–	[illegible]	–	[illegible]	[illegible]	[illegible]
[illegible]	Nat.	[illegible]	[illegible]	[illegible]	[illegible]	–	–	–	[illegible]	[illegible]	[illegible]	–	[illegible]	[illegible]	[illegible]
[illegible]	Nat. + Prod.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	–	[illegible]	[illegible]	–	[illegible]	[illegible]	[illegible]

INDUSTRIAL BOILER DESIGN DATA

Location No. 50 Test No. 111 - 112 Unit No. 1

Unit Description B&W FM Type, D Style Furnace

Installation Date	1967
Steam Output (10^3 lb/hr)	100
Design Pressure (psig)	150
Final Steam Temp (°F)	367
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	21 · 6 · 9
Furnace Area (ft^2)	730
Furnace Volume (ft^3)	1134
Burner Description	1 Coen Steam Atomized Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	PS 300
Fuel Temp at Burner (°F)	160
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	334

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel [illegible]

Test No.	NW-1	NW-2	NW-3	NW-4	NW-5	NW-6	NW-7
Test Type	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	85	85	80	82	82	83	84
Excess O_2 (%)	7.3	7.9	6.5	7.3	8.2	6.2	6.0
NO_x (ppm)*	498	465	521	560	536	527	508
NO (ppm)*	442	458	508	495	508	537	508
CO_2 dry (%)	8.8	9.0	10.0	10.0	8.9	10.6	10.8
CO (ppm)*	193	75	0	0	25	0	0
HC (ppm)*							
SO_x (ppm)*						606	
SO_2 (ppm)*						619	
Total Part. (lb/MBtu)							0.0152
Solid Part. (lb/MBtu)							0.0061
Boiler Efficiency (%)	81						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	126	130	130	130	140	130	130
Final Stm Temp. (°F)	[illegible]						"
Combus. Air Temp. (°F)	Ambient						"
Stack Temp. (°F)							302
Fuel Flow (GPH)	2000	2090		1950	1958	1960	2090
Fuel Temp. (°F)	160	158	162	158	160	160	158
Fuel Pres. (psig)	98	100	100	100	100	101	100
Furnace Pres. (in. H_2O)	0.8	0.8	0.8	0.9	0.9	0.8	0.8
Register (% open)	75-75	75-75	60-60	60-60	60-60	60-60	60-60

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL RUN DATA

Location [illegible] F

Unit 1

Fuel #6 Boiler

Test No.	111-8	111-9	111-10	111-11	111-12	111-13	111-14
Test Type	Comb. Air	66% w/ Air	66% w/ Air		66% w/ Air	66% w/ Air	66% w/ Air
Test Load (10^3 lb/hr)	80	80	80		80	80	80
Excess O_2 (%)	5.9	8.9	9.1		11.0	11.1	11.0
NO_x (ppm)*	401	499	484		578	578	584
NO (ppm)*	385	483	433		586	579	578
O_2 dry (%)	10.8	7.6	7.5		7.0	6.0	6.0
CO (ppm)*	0	119	121		0	0	95
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	125	129	124		128	124	125
Final Stm Temp. (°F)	Saturd						"
Combus. Air Temp. (°F)	Amb						"
Stack Temp. (°F)							
Fuel Flow (GPH)	170.5						
Fuel Temp. (°F)	187	186	184		182	185	182
Fuel Pres. (psig)	98	100	96		99	90	80
Furnace Pres. (in. H_2O)	0.7	0.9	0.8		0.9	1.6	1.2
Register (% open)	80-80	80-80	80-80		55-55	67-67	60-60

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.	111-7			
Location No.	2-7			
Fuel Type	PS 300			
Burner Type	Thermal Atomic			
Test Load ($lb/hr \times 10^3$)	85			
Stack Temp (°F)	322			
Stack Press. ($in.H_2O$)				
Impactor ΔP ($in.H_2O$) Psia	1.0			
Gas Volume (cm^3)	109.186			
Impactor Flow ($cm^3 \cdot s^{-1}$)	35.4			
Sample Time (sec)	3090			
Orientation	Horizontal			
D_{50} Cyclone (μm)				
Stage 1 (μm)	2.9			
Stage 2 (μm)	1.7			
Stage 3 (μm)	1.2			
Stage 4 (μm)	0.58			
Stage 5 (μm)	0.29			
Cyclone (mg)	None			
Stage 1 (mg)	0.868			
Stage 2 (mg)	0.148			
Stage 3 (mg)	0.240			
Stage 4 (mg)	0.272			
Stage 5 (mg)	0.216			
Filter (mg)	0.864			
Total Catch (mg)	2.11			
Comments	Baseline			

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel FS 300

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]						
Test Load (10^3 lb/hr)	93	90	75	60	57	70	70
Excess O_2 (%)	6.2	5.1	5.2	5.8	4.3	6.5	7.1
NO_x (ppm)*	378	458	447	405	408	424	487
NO (ppm)*	374	447	440	397	402	424	480
$(X)_2$ dry (%)	11.0	11.3	11.1	11.3	11.2	10.2	11.1
(X) (ppm)*	183	0	0	0	0	0	0
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)						0.070	
Boiler Efficiency (%)						0.066	
Smoke Spot No.						82	
Opacity (%)							
Final Stm Pres. (psig)	190	187	188	190	190	187	182
Final Stm Temp. (°F)	Saturat						
Combus. Air Temp. (°F)	Ambi						
Stack Temp. (°F)							
Fuel Flow						33.7	
Fuel Temp. (°F)	192	195	192	197	195	135	137
Fuel Pres. (psig)	80.1	140	80.5	87	80	77	104
Furnace Pres. (in. H_2O)	5.4	5.4	4.8	4.0	1.8	4.8	4.8
Register (% open)	85-85	85-85	80-80	65-65	57-57	80-80	80-80

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.	112			
Location No.	27			
Fuel Type	P.S. 300			
Burner Type	Steam Atom			
Test load (lb/hr x 10^3)	88			
Stack Temp (°F)	357			
Stack Press. (in.H_2O)				
Impactor ΔP (in.H_2O) min	0.15			
Gas Volume (cm^3)	72,000			
Impactor Flow ($cm^3 \cdot s^{-1}$)	333			
Sample Time (sec)	5400			
Orientation	Horizontal			
D_{50} Cyclone (μm)				
Stage 1 (μm)	2.8			
Stage 2 (μm)	1.7			
Stage 3 (μm)	1.1			
Stage 4 (μm)	0.56			
Stage 5 (μm)	0.28			
Cyclone (mg)	None			
Stage 1 (mg)	0.208			
Stage 2 (mg)	0.148			
Stage 3 (mg)	0.240			
Stage 4 (mg)	0.272			
Stage 5 (mg)	0.216			
Filter (mg)				
Total Catch (mg)	1.08			
Comments	Filter destroyed			

Density for Selected Smokes as a Function of Beam Angle

Location 27
Unit 1
Test No. 111-112

FUEL ANALYSIS SUMMARY

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Gasoline Content, %	Gravity, °API	Higher Heating Value Btu/lb	Btu/lb
102-103	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	–	0.071	31.1	0.0452	19,440
107-109	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	–	0.071	31.1	0.0452	19,440
111-112	#6 Oil (#5 Oil?)	86.46	10.31	1.87	1.29	0.77	0.30	–	0.50	15.1	0.0426	18,333
116-121	#6 Oil	85.95	10.21	0.23	2.74	0.31	0.03	–	–	–	0.0423	18,213
126-130	#6 Oil	No Fuel Sample Obtained For Analysis										
131-133	Coal	67.50	5.21	12.51	1.35	0.83	10.5	7.29	–	–	0.0276	11,863
134-139	Coal	68.30	4.76	11.81	1.16	1.46	9.71	3.66	–	–	0.0286	12,293
136-138	Coal	69.89	4.67	8.18	1.36	1.50	14.48	3.37	–	–	0.0295	12,688
159	#6 Oil	85.44	11.35	0.862	2.85	0.33	0.078	–	12.33	15.8	0.0432	18,580
160-164	#2 Oil	87.14	12.71	–	0.31	0.053	<0.001	–	0.027	35.1	0.0451	19,390
165-168	Coal	63.42	4.84	9.85	3.05	0.94	13.7	4.15	46.2	–	0.0276	11,873
169	Coal	67.50	5.12	12.51	1.35	0.83	10.5	7.29	–	–	0.0276	11,863
170-175	#6 Oil	86.60	10.94	0.31	1.60	0.30	0.25	–	9.30	15.1	0.0424	18,440
176-179	#6 Oil	86.17	11.55	–	1.91	0.30	0.07	–	–	–	0.0426	18,370
180-199	#6 Oil	85.30	11.30	1.12	0.39	0.49	0.08	–	0.53	35.7	0.0446	19,227
197-201	#6 Oil	86.68	12.16	0.65	0.37	0.24	0.009	–	1.61	29.2	0.0450	19,365

INDUSTRIAL BOILER DESIGN DATA

Location No. 28 Test No. AC-AS Unit No. 1

Unit Description Erie City Iron Works Boiler.

Installation Date	1951
Steam Output (10^3 lb/hr)	70
Design Pressure (psig)	160
Final Steam Temp (°F)	370
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9-14-20
Furnace Area (ft^2)	1116
Furnace Volume (ft^3)	2700
Burner Description	3 Forced Draft Ring Burners
Horiz. Burner Spacing (ft)	3.0
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	115
Stack Temp (°F)	260

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel Natural Gas

Test No.	102:1	103:1	103:2	103:3	104:1	104:2	104:3
Test Type	Base	Low Air	Low Air	Hi Air	0% Excess	0% Excess	0% Excess
Test Load (10^3 lb/hr)	29	30	29	30	29	29	28
Excess O_2 (%)	5.7	9.1	5.7	6.2	5.4	9.0	5.5
NO_x (ppm)[a]	211	172	160	197	182	143	138
NO (ppm)[a]	191	170	160	180	174	142	130
$(O)_2$ dry (%)	7.0	8.8	9.1	7.0	7.0	7.9	6.5
CO (ppm)[a]	0	0	21	0	0	44	0
HC (ppm)[a]	4	3	3	6	3	6	7
SO_x (ppm)[a]							
SO_2 (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	83		85		83		
Smoke Spot No.	0	0	0	0	0	0	0
Opacity (%)							
Final Stm Pres. (psig)	145	150	158	150	154	150	150
Final Stm Temp. (°F)	Saturated						"
Combus. Air Temp. (°F)	335	338	336	333	335	339	339
Stack Temp. (°F)	360	290	260	360	288	265	268
Fuel Flow (CFH/x 10^3	36	34	34	34.0	33.4	35	34
Fuel Temp. (°F)	Amb.						"
Fuel Pres. (psig)	0.5	0.5	0.5	0.5	2	2	2
Furnace Pres. (in. H_2O)	-0.1	-0.09	-0.015	-0.09	-0.09	-0.09	-0.09
Register (% open)	100	100	100	100	100 / 50 / 100		"

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel Natural Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Test Type	[illegible]	[illegible]	VPH	VPH	VPH	VPH	
Test load (10^3 lb/hr)	[illegible]	30	[illegible]	[illegible]	[illegible]	[illegible]	
Excess O_2 (%)	6.1	5.3	5.7	5.7	5.6	5.7	
NO_x (ppm)*	117	76	188	191	195	195	
NO (ppm)*	110	71	176	180	184	184	
$(X)_2$ dry (%)	7.6	7.9	7.6	9.7	7.6	7.6	
(X) (ppm)*	0	67	0	0	0	0	
HC (ppm)*	14	3	4	[illegible]	———	———	
SO_x (ppm)*	———	———	———	———	———	———	
SO_2 (ppm)*	———	———	———	———	———	———	
Total Part. (lb/MBtu)	———	———	———	———	———	———	
Solid Part. (lb/MBtu)	———	———	———	———	———	———	
Boiler Efficiency (%)	———	83	———	———	83	———	
Smoke Spot No.	0	0	0	0	0	0	
Opacity (%)	———	———	———	———	———	———	
Final Stm Pres. (psig)	161	160	160	161	160	160	
Final Stm Temp. (°F)	Saturat.					"	
Combus. Air Temp. (°F)	339	341	336	325	320	325	
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Fuel Flow (CFH) x 10^3	33.9	34	35	33.4	33.9	34	
Fuel Temp. (°F)	Amb.					"	
Fuel Pres. (psig)	[illegible]	[illegible]	0.5	0.5	0.5	0.5	
Furnace Pres. (in. H_2O)	-0.09	-0.1	-0.09	-0.09	-0.09	-0.09	
Register (% open)	[illegible]	[illegible]	100	100	100	100	

*at 3% O_2 dry

Location :-S
Unit 1
Test No. 122-125

Test No.	Type of Fuel	CH_4 %	C_2H_6 %	C_3H_8 %	C_4H_{10} %	C_5H_{12} %	C_6H_{14} %	N_2 %	CO_2 %	H_2 %	O_2 %	CV K.cal	Gross Kg.cal/Kg	Gross Kg.cal/M³	Nett Kg.cal/Kg	Nett Kg.cal/M³
121	Nat.	94.52	4.24	0.19	0.042	0.002	0.002	–	0.19	0.13	0.27	0.65	0.725	0.8407	0.6529	7567
122-125	Nat.	94.52	4.24	0.19	0.042	0.002	0.002	–	0.19	0.13	0.27	0.65	0.725	0.8407	0.6529	7567
126-129	Nat.	95.85	2.98	0.40	Traces	–	–	–	0.19	–	0.40	–	0.744	0.8862	0.6594	7855
130-133	Nat.	96.11	4.33	0.68	0.13	0.06	0.02	–	0.47	–	1.96	0.84	0.760	0.8472	0.6577	7329
134-137	Nat.	96.11	4.33	0.68	0.13	0.06	0.02	–	0.47	–	1.96	0.84	0.760	0.8472	0.6577	7329
138-141	Nat.	96.11	4.33	0.68	0.13	0.06	0.02	–	0.47	–	1.96	0.84	0.760	0.8472	0.6577	7329
142-145	Nat.	95.6	3.86	0.55	0.08	0.01	0.01	–	–	–	–	–	0.728	0.8047	0.6351	7019
146-149	Nat.	96.49	3.32	0.39	0.40	0.08	–	0.46	1.46	–	1.46	–	0.765	0.8472	0.6581	7288
150-153	Nat.	95.91	4.27	0.71	–	–	–	0.32	0.76	–	–	–	0.733	0.8452	0.6596	7607
154-157	Nat.	96.89	1.96	0.19	0.06	0.01	–	–	0.45	–	0.39	–	0.753	0.8438	0.6577	7351
158-161	Nat.	97.24	1.46	0.10	0.04	–	–	–	0.37	0.01	0.38	–	0.755	0.8472	0.6581	7403
162-165	Nat.	96.43	2.56	1.46	0.23	0.03	–	0.43	–	0.03	2.06	–	0.776	0.8555	0.6639	7611
	Nat.															

INDUSTRIAL BOILER DESIGN DATA

Location No. c2B Test No. AP6-130 Unit No. 1

Unit Description Erie City Iron Works Boiler.

Installation Date	1951
Steam Output (10^3 lb/hr)	70
Design Pressure (psig)	160
Final Steam Temp (°F)	370
Furnace Type	Watertube
Furnace Size L-W-H (ft)	9-14-20
Furnace Area (ft^2)	1116
Furnace Volume (ft^3)	2700
Burner Description	3 Jacked Steam Atom. Oil Burners
Horiz. Burner Spacing (ft)	3.0
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	201
Primary Air Temp (°F)	340
Stack Temp (°F)	275

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*							
SO_2 (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		[illegible]				[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]					[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]						"
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (GPH)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at % O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel #6 Oil

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	#2 Boos	#2 Boos	#2 Boos	#2 Boos	#2 Boos	Diversity	VPH
Test Load (10^3 lb/hr)	28	29	30.5	30	29	29	30
Excess O_2 (%)	6.7	5.9	5.7	9.8	6.9	5.8	6.8
NO_x (ppm)*	274	298	230	188	299	269	256
NO (ppm)*	270	288	229	183	289	268	241
O_2 dry (%)	10.3	11.4	10.7	11.6	10.9	11.9	10
CO (ppm)*	0	24	0	122	0	0	0
HC (ppm)*							
SO_2 (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)				86		87	86
Smoke Spot No.	5	5				3	3
Opacity (%)	5	5	5	10	5		5
Final Stm Pres. (psig)	101	100	107	102	101	103	100
Final Stm Temp. (°F)	Saturated						
Combus. Air Temp. (°F)	350	350	360	360	350	360	362
Stack Temp. (°F)	272	275	280	295		270	270
Fuel Flow (GPH)	234.6	236	240.9	239.8	238.9	232	240.2
Fuel Temp. (°F)	202	202	199	200	200	190	200
Fuel Pres. (psig)	87	87	87	87	85	60	85
Furnace Pres. (in. H_2O)	-0.09	-0.09	-0.08	-0.08	-0.09	-0.09	-0.08
Register (% open)	[illegible]	[illegible]	100	100	100	100	100

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL BOOM DATA

Location 28

Unit 1

Fuel #6 Oil

Test No.	130-2	130-3	130-4				
Test Type	Normal Air	Normal Air	Normal Air				
Test Load (10^3 lb/hr)	29	30	29				
Excess O_2 (%)	5.1	5.0	5.0				
NO_x (ppm)*	228	219	259				
NO (ppm)*	220	206	249				
CO_2 dry (%)	11.9	12.0	11.95				
CO (ppm)*	0	0	0				
HC (ppm)*	----	----	----				
SO_x (ppm)*	----	1350	----				
SO_2 (ppm)*	----	1310	----				
Total Part. (lb/MBtu)	0.150	----	----				
Solid Part. (lb/MBtu)	0.100	----	----				
Boiler Efficiency (%)	----	----	----				
Smoke Spot No.	4	----	----				
Opacity (%)	----	----	5				
Final Stm Pres. (psig)	140	138	142				
Final Stm Temp. (°F)	Saturn	----	↓				
Combus. Air Temp. (°F)	366	366	366				
Stack Temp. (°F)	270	270	270				
Fuel Flow (GPH)	238	250.2	249.6				
Fuel Temp. (°F)	200	212	210				
Fuel Pres. (psig)	70	55	60				
Furnace Pres. (in. H_2O)	-0.09	-0.09	-0.08				
Register (% open)	100	100	100				

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.	130-9			
Location No.	2B			
Fuel Type	#6 Oil			
Burner Type	Steam Atom.			
Test Load ($lb/hr \times 10^3$)	29			
Stack Temp (°F)	270			
Stack Press. ($in.H_2O$)	———			
Impactor ΔP ($in.H_2O$)	12.84			
Gas Volume (cm^3)	28220			
Impactor Flow ($cm^3 \cdot s^{-1}$)	47			
Sample Time (sec)	2760			
Orientation	Horizontal			
D_{50} Cyclone (μm)	———			
Stage D50 (μm) 1	5.0			
Stage D50 (μm) 2	3.0			
Stage D50 (μm) 3	2.0			
Stage D50 (μm) 4	1.0			
Stage D50 (μm) 5	0.4			
Cyclone (mg)	4.4			
Stage 1 (mg)	2.64			
Stage 2 (mg)	1.52			
Stage 3 (mg)	0.96			
Stage 4 (mg)	0.80			
Stage 5 (mg)	0.78			
Filter (mg)	0.42			
Total Catch (mg)	11.6			
Comments	Blow Spot during Test			

Barbarosh smoke No.

Deviations for Theoretical Airflows as a Function of Pressure Region

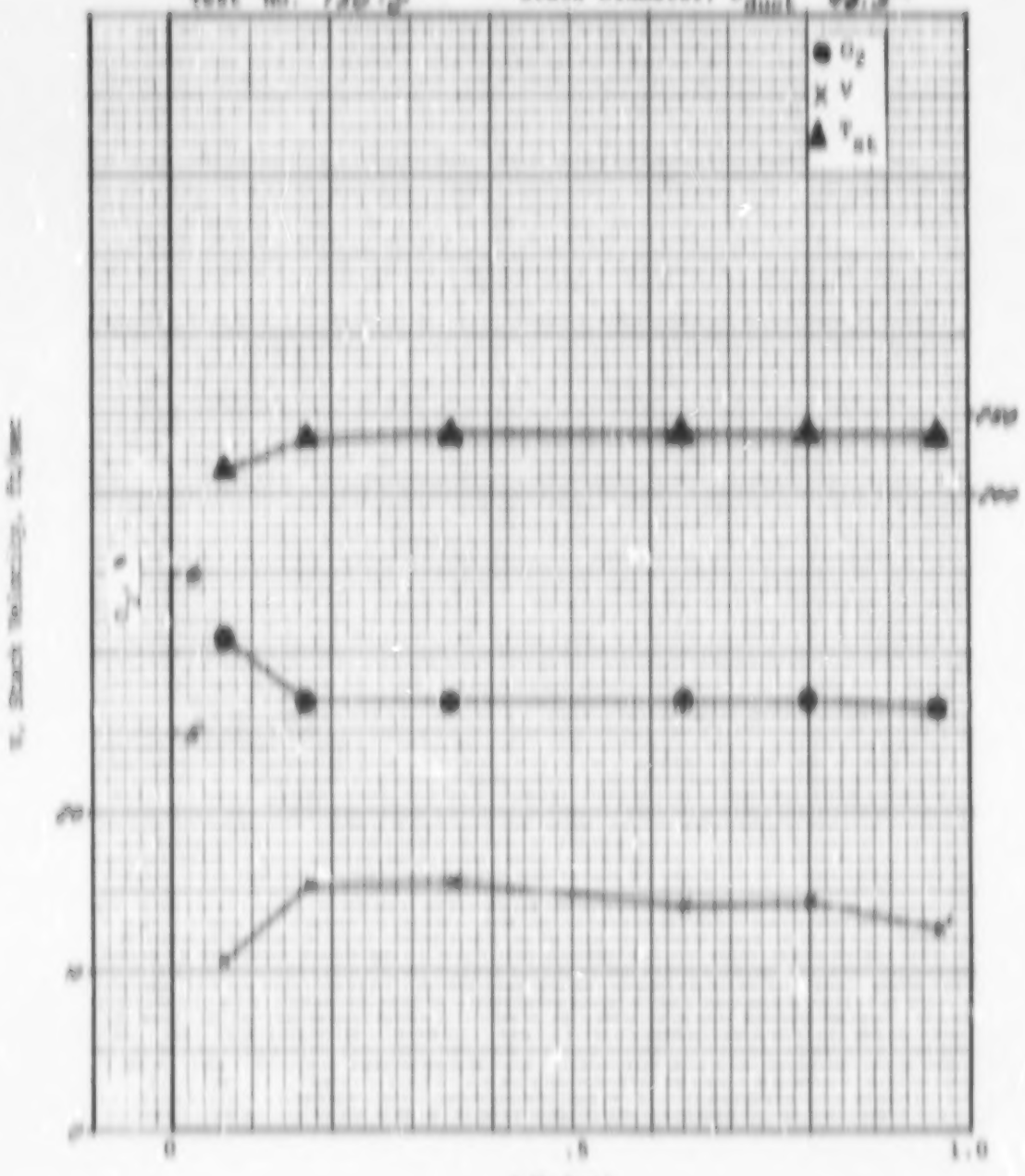
B 3 4

STACK TRAVERSE DATA

Location No. [illegible] Fuel [illegible]

Unit No. 1 Load [illegible] lb/hr

Test No. [illegible] Stack Diameter, D_{duct} [illegible]



Location 28
Unit 1
Test 66 (26 - 30

[redacted]

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Carbon Residue, %	Volatile, %	Higher Heating Value Btu/lb	Btu/lb
102-103	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	-	0.075	35.1	0.0452	19,440
107-108	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	-	0.075	35.1	0.0452	19,447
111-113	PS 300	86.46	10.31	1.07	1.29	0.77	0.10	-	0.50	25.1	0.0426	18,333
116-121	PS 300 / #5 Oil	85.95	10.21	0.22	2.74	0.31	0.03	-	-	-	0.0423	18,313
126-128	#6 Oil	No Fuel Sample Obtained For Analysis										
130-133	Coal	63.38	5.31	13.51	1.35	0.83	10.5	7.29	-	-	0.0276	11,863
134-139	Coal	68.39	4.78	11.01	1.36	1.46	9.71	3.66	-	-	0.0286	12,297
136-139	Coal	69.89	4.67	8.30	1.36	1.50	14.48	3.37	-	-	0.0286	12,300
159	#6 Oil	85.44	11.35	0.552	2.80	0.33	0.078	-	12.33	15.8	0.0432	18,580
160-164	#2 Oil	87.34	12.71	-	0.31	0.013	<0.001	-	0.037	35.1	0.0451	19,350
165-168	Coal	63.42	4.84	9.85	1.05	0.94	13.7	4.15	46.2	-	0.0276	11,873
169	Coal	63.59	5.12	13.51	1.35	0.83	10.5	7.29	-	-	0.0276	11,863
170-175	#6 Oil	86.60	10.96	0.31	1.60	0.38	0.35	-	9.80	15.1	0.0424	18,660
174-179	#6 Oil	86.17	11.55	-	1.51	0.38	0.07	-	-	-	0.0436	18,773
186-189	#6 Oil	85.10	11.10	3.13	0.15	0.49	0.08	-	8.53	35.7	0.0446	19,227
195-206	#6 Oil	86.60	12.36	0.65	0.37	0.34	0.009	-	1.61	39.2	0.0459	19,385

INDUSTRIAL BOILER DESIGN DATA

Location No. 69 Test No. 113 - 115 Unit No. 5

Unit Description Riley Stirl. Boiler. Serial No. 5768

Installation Date	1972
Steam Output (10^3 lb/hr)	150
Design Pressure (psig)	285
Final Steam Temp (°F)	417
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	28 : 11 : 19
Furnace Area (ft^3)	1795
Furnace Volume (ft^3)	6450
Burner Description	2 Cell Double Register Ring Burners
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	5.5'
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	
Primary Air Temp (°F)	380
Stack Temp (°F)	490

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 6

Fuel Natural Gas

Test No.	118:1	118:2	119:1	119:2	119:3	119:4	119:5
Test Type	Lo Ex Air	Base	Low Ex Air	Low Ex Air	Low Ex Air	Low Ex Air	Hi Ex Air
Test Load (10^3 lb/hr)	120	120	123	124	120	119	121
Excess O_2 (%)	5.4	6.3	4.7	4.6	5.0	5.2	6.0
NO_x (ppm)*	185	184	186	182	155	160	149
NO (ppm)*	168	144	138	134	119	123	105
O_2 dry (%)	7.6	8.0	8.4	8.2	8.0	8.0	8.7
CO (ppm)*	0	11	0	0	0	20	0
HC (ppm)*	102	108	102	118	117	84	92
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		82				83	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1812	1813	1802	1804	1803	1802	1803
Final Stm Temp. (°F)	Saturated						
Combus. Air Temp. (°F)	175	180	190	190	170	170	168
Stack Temp. (°F)	290	290	292	290	291	284	275
Fuel Flow (CFH/10^3	160.4	161.9	160.7	161.7	157.5	158.6	161.1
Fuel Temp. (°F)							
Fuel Pres. (psig)	1.9	1.9	1.8	1.8	1.8	1.80	1.82
Furnace Pres. (in H_2O)	0.0	0.0	0.1	0.2	0.0	0.0	0.0
Register (% open)	0.0	55 85	89	85	39 79	48 80	65 92

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location [illegible]

Unit 5

Fuel Natural Gas

Test No.	115-1						
Test Type	VFH						
Test Load (10^3 lb/hr)	186						
Excess O_2 (%)	3.2						
NO_x (ppm)*	157						
NO (ppm)*	154						
$(SO)_2$ dry (%)	18						
CO (ppm)*	17						
HC (ppm)*	87						
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	84						
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	1785						
Final Stm Temp. (°F)	Saturt.						
Combus. Air Temp. (°F)	590						
Stack Temp. (°F)	310						
Fuel Flow (cfm)							
Fuel Temp. (°F)							
Fuel Pres. (psig)	1307						
Furnace Pres. (in. H_2O)	0.0						
Register (% open)	1A 85 2A 85						

*at 3% O_2 dry

Figure 5.4.0

FUEL ANALYSIS SUMMARY

Gas Fuel

Location [illegible]
Unit 5
Test No. [illegible]

Test No.	Type of Gas	Mol %	C_3H_8 C_4H_{10} %	C_3H_8 %	C_4H_{10} %	C_5H_{12} %	C_6H_{14} %	N_2 %	CO_2 %	O_2 %	H_2S %	H_2O %	Density lbs/ft³	Density lbs/lb	Higher Heating Value Btu/ft³	Higher Heating Value Btu/lb
[illegible]	Nat. Fuel	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

INDUSTRIAL BOILER DESIGN DATA

Location No: [illegible]9 Test No: 118-[illegible]1 Unit No: 5

Unit Description Riley Bros. Boiler, Serial No. 3768

Installation Date	1952
Steam Output (10^3 lb/hr)	100
Design Pressure (psig)	285
Final Steam Temp (°F)	917
Furnace Type	Watertube
Furnace Size L-W-H (ft)	28 : 11 : 19
Furnace Area (ft^2)	1795
Furnace Volume (ft^3)	5450
Burner Description	8 Coen Steam Atomizing Burners with Venturi Register
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	5.5
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	245
Primary Air Temp (°F)	395
Stack Temp (°F)	510

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 6

Fuel #6 Oil

Test No.	HB-1	HB-1	HB-2	HB-3	HB-1	HB-2	HB-3
Test Type	Base	Low Air	Low Air	High Air	VPH	VPH	VPH
Test Load (10^3 lb/hr)	119	121	122	120	120	120	120
Excess O_2 (%)	5.0	4.1	5.1	5.0	5.0	4.8	5.3
NO_x (ppm)*	294	286	296	285	282	299	287
NO (ppm)*	282	258	260	279	276	288	281
CO_2 dry (%)	11.8	12.4	12.4	11.8	11.8	12.2	11.8
CO (ppm)*	0	0	0	0	0	0	0
HC (ppm)*	43	29	21	32	30	30	40
NO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	87		88		88		
Smoke Spot No.							
Opacity (%)		0	5-10	0	0	10	0
Final Stm Pres. (psig)	282	283	282	282	281	281	281
Final Stm Temp. (°F)	Saturat.						
Combus. Air Temp. (°F)	345	342	380	400	380	375	375
Stack Temp. (°F)	310	318	309	312	290	288	288
Fuel Flow (GPH)	7000		7016	7373	7377	7396	7386
Fuel Temp. (°F)	248	246	243	249	243	249	243
Fuel Pres. (psig)	70	75	75	75	75	75	75
Furnace Pres. (in. H_2O)	0	0.2	0.2	0.2	0.1	0.2	0.2
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 6

Fuel #6 Oil

Test No.	119:1	119:2	119:3	119:4	119:5	119:6	120:1
Test Type	100% Air	100% Air	750 Boos	750 Boos	750 Boos	750 Boos	100% Air
Test Load (10^3 lb/hr)	498	70	67	70	70	70	70
Excess O_2 (%)	5.8	5.2	6.8	6.0	5.1	5.4	5.1
NO_x (ppm)*	248	258	191	177	171	180	252
NO (ppm)*	239	248	185	169	169	182	250
$(O)_2$ dry (%)	11.3	11.4	9.2	9.8	10.0	11.8	11.9
CO (ppm)*	0	0	0	24	65	35	0
HC (ppm)*	———	19	21	20	21	44	32
SO_x (ppm)*	———	———	———	———	———	1305	———
SO_2 (ppm)*	———	———	———	———	———	1289	———
Total Part. (lb/MBtu)	0.057	———	———	———	———	0.164	———
Solid Part. (lb/MBtu)	0.049	———	———	———	———	0.150	———
Boiler Efficiency (%)	88	———	———	87	———	88	———
Smoke Spot No.	———	———	———	———	———	———	———
Opacity (%)	6	———	10	20	25	———	———
Final Stm Pres. (psig)	277	281	278	278	278	275	277
Final stm Temp. (°F)	Saturt	———	———	———	———	———	———
Combus. Air Temp. (°F)	101	101	358	358	361	365	360
Stack Temp. (°F)	296	296	296	293	295	270	289
Fuel Flow (GPH)	4260	4117	3871	4307	4105	4393	4306
Fuel Temp. (°F)	287	296	291	291	288	295	295
Fuel Pres. (psig)	50	45	80	75	92	94	45
Furnace Pres. (in. H_2O)	1.2	1.2	1.3	1.5	1.0	1.3	1.2
Register (% open)	1: 55 2: 85	1: 85 2: 85	1: 60 2: 60	1: 55 2: 55	1: 90 2: 80	1: 55 2: 55	1: 90 2: 85

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL RXSM DATA

Location 19

Unit 5

Fuel #6 Oil

Test No.	120:2	120:3	121:1	121:2	121:3		
Test Type	Visible Bilp	Visible Bilp	Control Air	Control Air	Control Air		
Test Load (10^3 lb/hr)	70	70	72	70	69.6		
Excess O_2 (%)	5.2	5.2	5.4	5.4	5.5		
NO_x (ppm)*	214	246	264	295	268		
NO (ppm)*	211	242	260	291	264		
CO_2 dry (%)	11.6	12.0	11.9	11.9	11.0		
CO (ppm)*	0	0	0	0	0		
HC (ppm)*	32		26	96	32		
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		88	88				
Smoke Spot No.							
Opacity (%)			5	5	5		
Final Stm Pres. (psig)	278	278	277	277	278		
Final Stm Temp. (°F)	Satur.				▶		
Combus. Air Temp. (°F)	360	361	359	359	359		
Stack Temp. (°F)	264	267	261	268	268		
Fuel Flow (GPH)	4260	4003	4157	4300	4328		
Fuel Temp. (°F)	220	191	203	236	201		
Fuel Pres. (psig)	99	93	97	96	95		
Furnace Pres. (in H_2O)	-.2	-.3	-.4	-.5	-.3		
Register (% open)	10 60 30 35	10 60 30 35	30 60 30 35	30 60 30 35	30 60 30 35		

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.	121-1	121-2	121-3	
Location No.	C9	C9	C9	
Fuel Type	#6 @ 1		"	
Burner Type	Circular		"	
Test Load (lb/hr x 10^3)	7.2	7.0	6.9.5	
Stack Temp (°F)	261	258	258	
Stack Press. (in.H_2O)	———	———	———	
Impactor ΔP (in.H_2O) PSI	———	0.74	0.74	
Gas Volume (cm^3)	150,100	200,000	214,682	
Impactor Flow ($cm^3 \cdot s^{-1}$)	17.8	20	17.9	
Sample Time (sec)	8,460	15,000	12,000	
Orientation	Mo-1		"	
D_{50} Cyclone (μm)	———	———	———	
Stage 1 (μm)	9.1	7.86	9.1	
Stage 2 (μm)	2.9	2.81	2.9	
Stage 3 (μm)	1.6	1.54	1.6	
Stage 4 (μm)	0.81	0.77	0.81	
Stage 5 (μm)	0.41	0.38	0.41	
Cyclone (mg)	None	None	None	
Stage 1 (mg)	1.0	1.02	11.7	
Stage 2 (mg)	1.08	0.2	0.62	
Stage 3 (mg)	1.21	0.010	1.89	
Stage 4 (mg)	0.990	1.10	1.09	
Stage 5 (mg)	0.288	2.37	0.848	
Filter (mg)	0.90	0.500	0.598	
Total Catch (mg)	5.17	8.02	16.99	
Comments	———	———	Soot shot blown during test	

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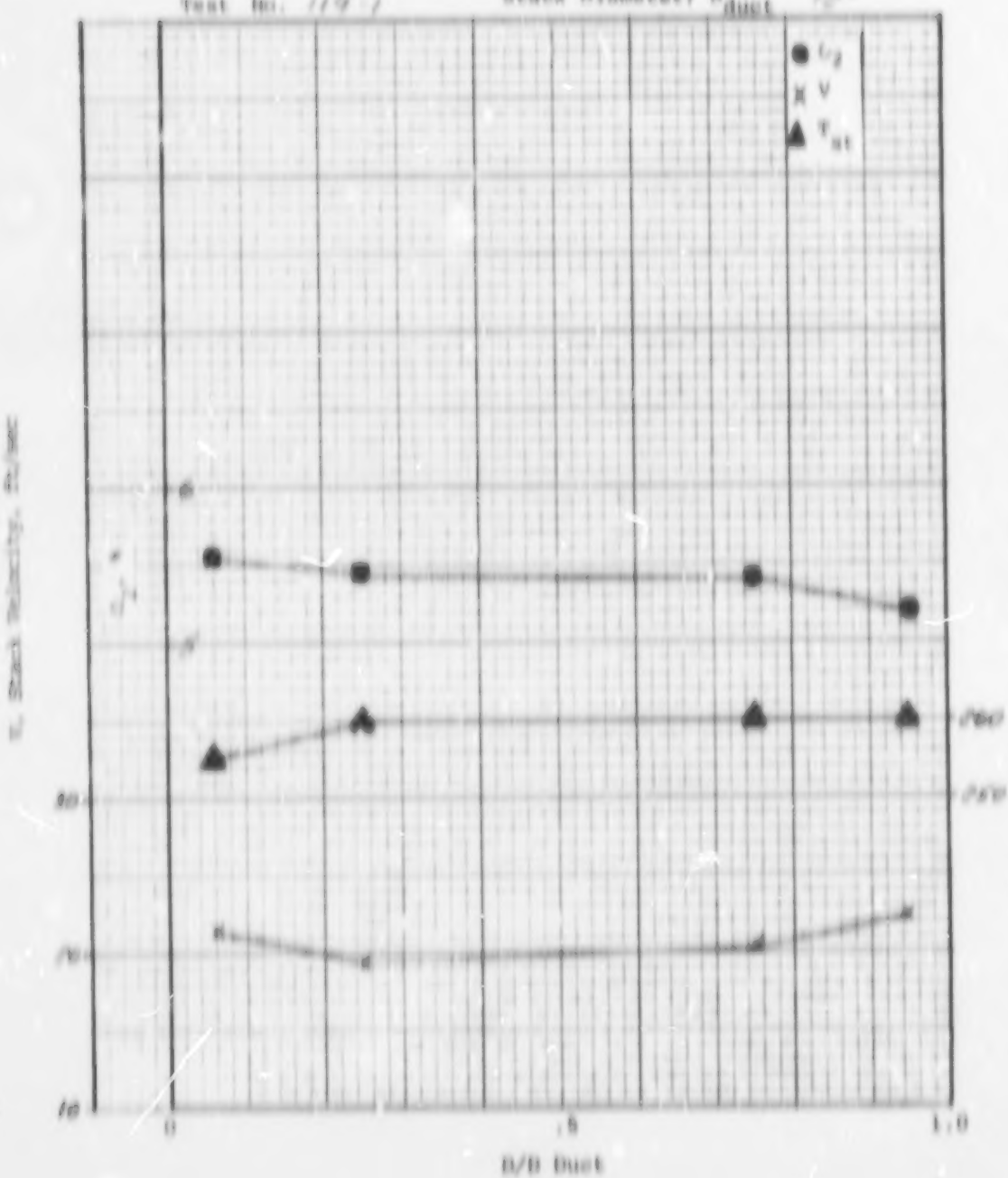
STACK TRAVERSE DATA

Location No: 19 Fuel #6 Oil

Unit No: 5 Load 89,500 lb/hr

Test No: 1179-1 Stack Diameter, D_{duct} 20'



Location 24
Unit E
Test 66 16-17

FUEL ANALYSIS SUMMARY

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Carbon Residue, %	Gravity, °API	Higher Heating Value Btu/lb	Btu/lb
103-103	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
107-108	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
111-112	PS 300 (85 Oil)	86.46	10.31	1.87	1.29	0.77	0.10	-	8.50	15.1	0.0426	18,333
116-121	#6 Oil	85.95	10.21	0.22	2.70	0.31	0.60	-	-	-	0.0423	18,213
126-130	#6 Oil	No Fuel Sample Obtained For Analysis										
131-133	Coal	62.50	5.21	12.51	1.15	0.83	10.5	7.29	-	-	0.0276	11,863
134-139	Coal	68.30	4.70	11.01	1.16	1.46	9.71	1.66	-	-	0.0286	12,293
136-139	Coal	69.89	4.67	8.10	1.36	1.50	14.48	3.37	-	-	0.0286	12,300
159	#6 Oil	85.46	11.35	0.002	2.80	0.33	0.078	-	12.33	15.8	0.0432	18,580
160-164	#2 Oil	87.14	12.71	-	0.31	0.013	<0.001	-	0.027	35.1	0.0451	19,398
165-168	Coal	63.42	4.54	9.85	1.05	0.94	13.7	4.15	46.2	-	0.0276	11,873
169	Coal	62.50	5.12	12.51	1.15	0.83	10.5	7.29	-	-	0.0276	11,863
170-175	#6 Oil	86.60	10.96	0.31	1.60	0.30	0.25	-	9.80	15.1	0.0434	18,660
176-179	#6 Oil	86.17	11.55	-	1.91	0.30	0.07	-	-	-	0.0436	18,773
180-199	#6 Oil	85.10	11.10	1.12	0.19	0.49	0.08	-	8.53	25.7	0.0446	19,227
195-206	#6 Oil	86.68	12.16	0.65	0.37	0.14	0.009	-	1.61	29.2	0.0450	19,365

INDUSTRIAL BOILER DESIGN DATA

Location No. 30 Test No. 154 - 158 Unit No. 5

Unit Description Erie City Stoker chevrefer

Installation Date	1948
Steam Output (10^3 lb/hr)	125
Design Pressure (psig)	450
Final Steam Temp (°F)	750
Furnace Type	Watertube
Furnace Size L-W-H (ft)	17 - 14 - 88
Furnace Area (ft^2)	2080
Furnace Volume (ft^3)	6700
Burner Description	4 Detroit Mate Grate Stokers
Horiz. Burner Spacing (ft)	4.9
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	200
Stack Temp (°F)	320

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL RUN DATA

Location 30

Unit 8

Fuel Coal

Test No.	154-1	154-2	154-3	154-5	154-6	155-1	155-2
Test Type	Without Air	Manual	Without Air	Without Air	Without Air	Low Air	Low Air
Test Load (10^3 lb/hr)	88	82	82	82	81.5	83	82
Recess O_2 (%)	6.2	6.2	6.1	6.2	6.2	5.4	4.7
NO_x (ppm)*	323	320	298	312	279	237	253
NO (ppm)*	318	314	292	307	268	230	221
$(S)_2$ dry (%)	12.8	12.8	12.9	12.8	12.9	13.6	13.2
CO (ppm)*	37	24	24	31	24	58	22
HC (ppm)*							
SO_x (ppm)*			1114				
SO_2 (ppm)*			1091				
Total Part (lb/MBtu)		1.03					1.97
Solid Part. (lb/MBtu)		1.05					1.95
Boiler Efficiency (%)		87					88
Smoke Spot No.	5	5	5	6	5.5	7	6
Opacity (%)	10						
Final Stm Pres. (psig)	1000	996	995	991	993	980	990
Final Stm Temp. (°F)	711	691	703	700	700	691	690
Combus. Air Temp. (°F)	200	200	200	197	198	202	198
Stack Temp. (°F)	325	320	320	318	318	300	319
Fuel Flow							
Fuel Temp. (°F)	Ambient						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.15	-0.15	-0.15	-0.17	-0.13	-0.14	-0.13
Register (# open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location 50

Unit 8

Fuel Coal

Test No.	155 : 3	156 : 1	156 : 2	158 : 3	158 : 1	158 : 2	159 : 1
Test Type	Low Ai	6.91/110 Ai	6.91/110 Ai	OCA	VPH	VPH	6.91/110 Ai
Test Load (10^3 lb/hr)	82.5	82	82	82	82	82.5	78
Excess O_2 (%)	5.2	6.3	6.6	6.1	6.9	5.0	10.3
NO_x (ppm)*	316	298	319	287	265	279	312
NO (ppm)*	310	282	315	279	260	276	312
$(\%)_2$ dry (%)	13.6	13.8	12.5	12.9	13	13.8	9.4
CO (ppm)*	29	96	90	15	24	31	50
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)				87		84	
Smoke Spot No.	6.0	6	6	9	8	7	1
Opacity (%)							
Final Stm Pres. (psig)	950	950	940	960	945	945	945
Final Stm Temp. (°F)	688	690	700	681	698	688	695
Combus. Air Temp. (°F)	170	200	200	200	178	180	180
Stack Temp. (°F)	302	326	304	330	338	330	306
Fuel Flow							
Fuel Temp. (°F)	Amb.						"
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.14	-0.12	-0.15	-0.15	-0.2	-0.10	-0.12
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL NOX DATA

Location [illegible]

Unit 8

Fuel Coal

Test No.	189-2	189-3	189-4	189-5	189-6	189-7	189-8
Test Type	[illegible] Air	[illegible]	[illegible] [illegible]	[illegible] Air	[illegible] Air	[illegible] Air	[illegible] Air
Test Load (10^3 lb/hr)	48	48	48	48.0	50	49.5	50
Excess O_2 (%)	9.0	7.9	10.8	10.0	9.9	9.6	9.2
NO_x (ppm)*	403	195	361	300	371	342	327
NO (ppm)*	288	191	348	351	360	335	317
O_2 dry (%)	10.9	11.0	9.4	9.7	10	9.8	10.1
CO (ppm)*	45	60	13	38	68	82	130
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)			1.76				
Solid Part. (lb/MBtu)			1.72				
Boiler Efficiency (%)		88	88			88	
Smoke Spot No.	4	4	6				
Opacity (%)							
Final Stm Pres. (psig)	990	990	990	990	990	985	985
Final Stm Temp. (°F)	828	900	700	700	705	700	706
Combus. Air Temp. (°F)	190	190	190	180	180	180	180
Stack Temp. (°F)	308	300	340	305	300	300	300
Fuel Flow							
Fuel Temp. (°F)	Amb						"
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.18	-0.15	-0.2	-0.12	-0.12	-0.12	-0.18
Register (% open)							

*at 10 O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location EP

Unit 8

Fuel Coal

Test No.	159-9	159-10					
Test Type	Normal Air	Optimize Air					
Test Load (10^3 lb/hr)	50	50					
Excess O_2 (%)	2.4	2.7					
NO_x (ppm)*	330	269					
NO (ppm)*	302	266					
CO_2 dry (%)	10.1	11.3					
CO (ppm)*	78	66					
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		86					
Smoke Spot No.							
Opacity (%)	20	20					
Final Stm Pres. (psig)	950	950					
Final Stm Temp. (°F)	710	680					
Combus. Air Temp. (°F)	180	182					
Stack Temp. (°F)	302	298					
Fuel Flow							
Fuel Temp. (°F)	Amb.	Amb.					
Fuel Pres. (psig)							
Furnace Pres. (in H_2O)	-0.2	-0.2					
Register (% open)							

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.	157 D			
Location No.	5C			
Fuel Type	Coal			
Burner Type	Horizontal Stoker			
Test Load (lb/hr x 10^3)	50			
Stack Temp (°F)	380			
Stack Press. (in.H_2O)	1.66			
Impactor ΔP (in.H_2O)	40			
Gas Volume (cm^3)	49,610			
Impactor Flow ($cm^3 \cdot s^{-1}$)	96.5			
Sample Time (sec)	3540			
Orientation	Horizontal			
D_{50} Cyclone (μm)	10.9			
Cascade Impactor Stage Cut Points	1 (μm)	0.5			
	2 (μm)	1.5			
	3 (μm)	4.0			
	6 (μm)	8.5			
	9 (μm)	0.26			
Cascade Impactor Catch	Cyclone (mg)	75.1			
	Stage 1 (mg)	0.31			
	Stage 2 (mg)	0.99			
	Stage 3 (mg)	0.488			
	Stage 6 (mg)	0.396			
	Stage 9 (mg)	0.588			
	Filter (mg)	0.120			
Total Catch (mg)		78.8			
Comments		Baseline			

Location 30
Unit 6
Test 66 (70 - 80

FUEL ANALYSIS REPORT

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Chlorine, Grains/Gal.	Specific Gravity, API @	Higher Heating Value GJ/kg	Higher Heating Value Btu/lb
102-103	#2 Oil	85.94	13.72	0.09	0.46	0.045	0.003	-	0.071	31.1	0.0452	19,440
107-108	#2 Oil	85.94	13.72	0.09	0.46	0.045	0.003	-	0.071	31.1	0.0452	19,440
111-112	#5 300 (#5 Oil)	86.46	10.31	1.07	1.25	0.77	0.15	-	0.50	15.1	0.0426	18,313
120-121	#6 Oil	85.95	10.31	0.22	2.74	0.33	0.01	-	-	-	0.0423	18,213
126-128	#6 Oil	No Fuel Sample Obtained For Analysis										
130-133	Coal	62.56	5.31	12.51	1.15	0.83	10.5	7.39	-	-	0.0276	11,863
134-139	Coal	68.30	4.70	11.05	1.16	1.46	9.71	3.66	-	-	0.0286	12,293
154-159	Coal	69.89	4.67	8.16	1.36	1.56	14.48	1.37	-	-	0.0286	12,300
159	#6 Oil	85.44	11.35	0.002	2.80	0.33	0.078	-	12.33	15.0	0.0432	18,580
160-164	#2 Oil	87.14	12.71	-	0.31	0.013	<0.001	-	0.027	35.1	0.0451	19,390
165-168	Coal	63.42	4.84	9.85	1.05	0.94	13.7	4.15	66.7	-	0.0276	11,873
169	Coal	62.50	5.12	12.51	1.15	0.83	10.5	7.39	-	-	0.0276	11,863
170-175	#6 Oil	86.65	10.96	0.31	1.68	0.36	0.19	-	9.08	15.1	0.0434	18,660
176-179	#6 Oil	86.17	11.55	-	1.91	0.38	0.07	-	-	-	0.0436	18,773
180-189	#6 Oil	85.10	11.10	3.12	0.19	0.49	0.08	-	0.53	25.7	0.0446	19,227
195-206	#6 Oil	86.68	12.16	0.65	0.37	0.14	0.009	-	1.61	29.2	0.0450	19,365

INDUSTRIAL BOILER DESIGN DATA

Location No. 51 Test No. 131-138 & 169 Unit No. 7

Unit Description Erie City Boiler with 8 CE Raymond Bowl Mills

Installation Date	1968
Steam Output (10^3 lb/hr)	250
Design Pressure (psig)	700
Final Steam Temp (°F)	910
Furnace Type	Watertube
Furnace Size L-W-H (ft)	24-24-39
Furnace Area (ft^2)	9960
Furnace Volume (ft^3)	19000
Burner Description	8 CE Pulverized Coal Burners
Horiz. Burner Spacing (ft)	6.6
Vert. Burner Spacing (ft)	6.3
Test Fuel	Coal
Fuel Temp at Burner (°F)	157
Primary Air Temp (°F)	600
Stack Temp (°F)	330

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location: [illegible]

Unit: [illegible]

Fuel: Coal

Test No.	181-1	181-2	181-3	181-4	182-1	183-1	183-2
Test Type	Design Air	Design Air	Design Air	[illegible]	Low Air	Low Load	[illegible]
Test Load (10^3 lb/hr)	132	130	130	130	132	60	63
Excess O_2 (%)	7.8	7.7	7.4	7.8	6.6	7.2	7.5
NO$_x$ (ppm)*	894	969	884	902	866	1011	618
NO (ppm)*	865	960	863	915	850	1006	591
CO$_2$ dry (%)	12.7	11.5	11.9	11.8	12.6	11.9	11.75
CO (ppm)*	0	0	0	0	0	0	0
HC (ppm)*	———	———	———	———	———	———	———
NO$_x$ (ppm)*	———	———	950	———	———	———	———
NO$_2$ (ppm)*	———	———	949	———	———	———	———
Total Part. (lb/MBtu)	———	———	———	5.80	———	———	———
Solid Part. (lb/MBtu)	———	———	———	5.8	———	———	———
Boiler Efficiency (%)	———	———	———	88	88	88	88
Smoke Spot No.	5.0	4.5	———	———	4.5	2.0	4.5
Opacity (%)	40	50	70		55		40
Final Stm Pres. (psig)	940	872	870	880	880	890	864
Final Stm Temp. (°F)	870	880	870	862	870	810	759
Combus. Air Temp. (°F)	590	592	591	590	592	488	479
Stack Temp. (°F)	320	322	330	330	338	300	310
Fuel Flow (lb/hr)	19,475	18,000	18,100	16,818	18,000	10,000	10,000
Fuel Temp. (°F)	150	156	156	157	160	162	161
Fuel Pres. (psig)	———	———	———	———	———	———	———
Furnace Pres. (in.H_2O)	-0.1	-0.25	-0.1	-0.25	-0.25	-0.1	-0.1
Register (% open)	75-80	———	75-80	75-80	75-80	75-80	75-80

*at 3% O_2 dry

BOILER PERFORMANCE MEASUREMENTS

AND CONTROL ROOM DATA

Location [illegible]

Unit 7

Fuel Coal

Test No.	169-1	169-2	169-3				
Test Type	Base	Low Int Air	Base Int Air				
Test Load (10^3 lb/hr)	160	140	140				
Excess O_2 (%)	5.0						
NO_x (ppm)*	718						
CO (ppm)*	870						
O_2 dry (%)							
CO (ppm)*	0						
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)	1.01						
Boiler Efficiency (%)	88						
Smoke Spot No.							
Opacity (%)	40						
Final Stm Pres. (psig)	950	950	950				
Final Stm Temp. (°F)	870	870	870				
Combus. Air Temp. (°F)	107	107	107				
Stack Temp. (°F)	330	330	330				
Fuel Flow #/hr	12,742	10,570	10,085				
Fuel Temp. (°F)	150	150	145				
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.3	-0.3	-0.3				
Register (% open)	75-80	75-80	70-80				

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.		89-6			
Location No.		81			
Fuel Type		Coal			
Burner Type		Pulver.			
Test Load (lb/hr x 10^3)		100			
Stack Temp (°F)		291			
Stack Press. (in.H_2O)					
Impactor ΔP (in.H_2O)					
Gas Volume (m^3)		0.660			
Impactor Flow ($m^3 \cdot s^{-1}$)		23.7			
Sample Time (sec)		1800			
Orientation		Horizont.			
D_{50} Cyclone (μm)		15.8			
Cascade Impactor Stage Cut Diameters (μm)	1 (μm)	3.69			
	2 (μm)	2.12			
	3 (μm)	1.91			
	4 (μm)	0.71			
	5 (μm)	0.35			
Cyclone/Cascade Impactor Catch	Cyclone (mg)	71.89			
	Stage 1 (mg)	90.63			
	Stage 2 (mg)	20.90			
	Stage 3 (mg)	0.11			
	Stage 4 (mg)	1.30			
	Stage 5 (mg)	1.02			
	Filter (mg)	0.150			
Total Catch (mg)		194.19			
Comments		Heavy stage 1 deposit during test			

CASCADE IMPACTOR DATA

Test No.		[illegible]	[illegible]	[illegible]	[illegible]
Location No.		[illegible]	[illegible]	[illegible]	[illegible]
Fuel Type		[illegible]	[illegible]	[illegible]	[illegible]
Burner Type		[illegible]	[illegible]	[illegible]	[illegible]
Test Load ($lb/hr \times 10^3$)		[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp (°F)		[illegible]	[illegible]	[illegible]	[illegible]
Stack Press. ($in.H_2O$)		[illegible]	[illegible]	[illegible]	[illegible]
Impactor ΔP ($in.H_2O$)		[illegible]	[illegible]	[illegible]	[illegible]
Gas Volume (cm^3)		[illegible]	[illegible]	[illegible]	[illegible]
Impactor Flow ($cm^3 \cdot s^{-1}$)		[illegible]	[illegible]	[illegible]	[illegible]
Sample Time (sec)		[illegible]	[illegible]	[illegible]	[illegible]
Orientation		[illegible]	[illegible]	[illegible]	[illegible]
D_{50} Cyclone (μm)		[illegible]	[illegible]	[illegible]	[illegible]
Stage Cut Diameters (μm)	1 (μm)	[illegible]	[illegible]	[illegible]	[illegible]
	2 (μm)	[illegible]	[illegible]	[illegible]	[illegible]
	3 (μm)	[illegible]	[illegible]	[illegible]	[illegible]
	4 (μm)	[illegible]	[illegible]	[illegible]	[illegible]
	5 (μm)	[illegible]	[illegible]	[illegible]	[illegible]
Cyclone & Filter Catch (mg)	Cyclone (mg)	[illegible]	[illegible]	[illegible]	[illegible]
	Stage 1 (mg)	[illegible]	[illegible]	[illegible]	[illegible]
	Stage 2 (mg)	[illegible]	[illegible]	[illegible]	[illegible]
	Stage 3 (mg)	[illegible]	[illegible]	[illegible]	[illegible]
	Stage 4 (mg)	[illegible]	[illegible]	[illegible]	[illegible]
	Stage 5 (mg)	[illegible]	[illegible]	[illegible]	[illegible]
	Filter (mg)	[illegible]	[illegible]	[illegible]	[illegible]
Total Catch (mg)		[illegible]	[illegible]	[illegible]	[illegible]
Comments		upstream dust collector	downstream dust collector	upstream dust collector	downstream dust collector

Location 31
Unit 7
Test No. 131 - 133 & 169

FUEL ANALYSIS SUMMARY

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, C, %	Hydrogen, H, %	Oxygen, O, %	Sulfur, S, %	Nitrogen, N, %	Ash, %	Moisture, %	Volatile Combustible, %	Heating Value, Dry Basis, %	Higher Heating Value Btu/lb	Higher Heating Value Btu/lb
102-103	#2 Oil	85.94	13.72	0.89	0.40	0.045	0.003	-	0.071	31.1	0.0453	19,440
107-108	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
111-112	#2 Oil (85 Oil)	86.46	14.31	1.07	1.35	0.77	0.10	-	0.56	35.1	0.0436	18,335
116-121	#6 Oil	85.55	10.21	0.22	2.74	0.31	0.03	-	-	-	0.0423	18,324
126-130	#6 Oil	No Fuel Sample Obtained For Analysis										
131-133	Coal	62.50	5.21	12.51	1.15	0.83	10.5	7.29	-	-	0.0276	11,863
134-139	Coal	68.30	4.70	11.01	1.76	1.45	9.72	3.66	-	-	0.0286	12,293
156-159	Coal	69.89	4.67	8.10	1.36	1.50	14.48	3.37	-	-	0.0286	12,350
159	#6 Oil	85.44	21.35	0.002	2.80	0.33	0.078	-	12.33	15.8	0.0432	18,580
160-164	#2 Oil	87.14	12.71	-	0.31	0.013	<0.001	-	0.027	35.1	0.0451	19,390
165-168	Coal	63.42	4.84	9.85	1.05	0.94	13.7	4.15	46.2	-	0.0276	11,873
169	Coal	62.50	5.12	12.51	1.15	0.83	10.5	7.29	-	-	0.0276	11,863
170-175	#6 Oil	86.60	10.94	0.31	1.60	0.38	0.25	-	9.00	15.1	0.0434	18,680
176-179	#6 Oil	86.17	11.55	-	1.91	0.38	0.47	-	-	-	0.0436	18,770
186-189	#6 Oil	85.10	11.38	1.12	0.19	0.45	0.08	-	8.53	25.7	0.0446	19,207
195-196	#6 Oil	86.68	12.16	0.65	0.37	0.14	0.089	-	1.61	29.2	0.0450	19,385

INDUSTRIAL BOILER DESIGN DATA

Location No. 50 Test No. 100 - 99.0 Unit No. 9

Unit Description Cleaver Brooks Boiler, Model CBI-50-84

Installation Date	1969
Steam Output (10^3 lb/hr)	150
Design Pressure (psig)	575
Final Steam Temp (°F)	700
Furnace Type	Watertube
Furnace Size L-W-H (ft)	24 - 7 - 18
Furnace Area (ft^2)	1944
Furnace Volume (ft^3)	9,340
Burner Description	1 Pembody Flexiweld 50 Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	390
Stack Temp (°F)	500

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 4

Fuel Natural Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	Ambient	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in.H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 4

Fuel Natural Gas

Test No.	[illegible]	[illegible]					
Test Type	[illegible]	[illegible]					
Test Load (10^3 lb/hr)	[illegible]	[illegible]					
Excess O_2 (%)	[illegible]	[illegible]					
NO_x (ppm)*	[illegible]	[illegible]					
NO (ppm)*	[illegible]	[illegible]					
$(O)_2$ dry (%)	[illegible]	[illegible]					
CO (ppm)*	[illegible]	[illegible]					
HC (ppm)*	[illegible]	[illegible]					
SO_x (ppm)*	[illegible]	[illegible]					
SO_2 (ppm)*	[illegible]	[illegible]					
Total Part. (lb/MBtu)	[illegible]	[illegible]					
Solid Part. (lb/MBtu)	[illegible]	[illegible]					
Boiler Efficiency (%)	[illegible]	[illegible]					
Smoke Spot No.	[illegible]	[illegible]					
Opacity (%)	[illegible]	[illegible]					
Final Stm Pres. (psig)	[illegible]	[illegible]					
Final Stm Temp. (°F)	[illegible]	[illegible]					
Combus. Air Temp. (°F)	[illegible]	[illegible]					
Stack Temp. (°F)	[illegible]	[illegible]					
Fuel Flow (c/h/x 10^3	[illegible]	[illegible]					
Fuel Temp. (°F)	Amb.	Amb.					
Fuel Pres. (psig)	[illegible]	[illegible]					
Furnace Pres. (in. H_2O)	[illegible]	[illegible]					
Register (% open)	[illegible]	[illegible]					

*at 3% O_2 dry

NO, ppm
CO, ppm

INDUSTRIAL BOILER DESIGN DATA

Location No. 60 Test No. 108-108 Unit No. 1

Unit Description Erie City 4 drum Boiler, Serial No. 10858

Installation Date	1964
Steam Output (10^3 lb/hr)	120
Design Pressure (psig)	925
Final Steam Temp (°F)	750
Furnace Type	Watertube
Furnace Size L-W-H (ft)	17-13-29
Furnace Area (ft^2)	2150
Furnace Volume (ft^3)	6250
Burner Description	4 Erie City Gas Ring Burners
Horiz. Burner Spacing (ft)	6
Vert. Burner Spacing (ft)	4
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	
Stack Temp (°F)	320

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL BOOK DATA

Location [illegible]

Unit 1

Fuel Natural Gas

Test No.	1A-1	1A-2	1A-3	1A-4	1A-5	1A-6	1A-7
Test Type	Normal Air	Normal Air	Baseline	Normal Air	Varied	Lower Air	Lower Air
Test Load (10^3 lb/hr)	82	83	83	80	82	83	83
Excess O_2 (%)	4.3	4.5	4.4	4.4	4.4	3.7	3.1
NO_x (ppm)*	231	231	230	215	220	227	226
NO (ppm)*	210	210	208	202	200	208	209
$(O)_2$ dry (%)	8.6	8.6	8.4	8.6	8.6	8.9	8.6
CO (ppm)*	0	0	0	0	48	0	0
HC (ppm)*							
NH_3 (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			82		82		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	412	412	411	411	411	411	411
Final Stm Temp. (°F)	715	715	716	715	715	702	715
Combus. Air Temp. (°F)							
Stack Temp. (°F)	320	320	320	325	325	318	315
Fuel Flow (cf/hr)x10^3	106	108	108	108	108	108	108
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	2.7	2.7	2.7	2.7	2.6	2.5	2.5
Furnace Pres. (in.H_2O)	-.4	-.4	-.5	-.4	-.4	-.4	-.4
Register (% open)	50 : 50 50 : 50	50 : 50 50 : 50	50 : 50 50 : 50	50 : 50 50 : 50	50 : 50 50 : 50	50 : 50 50 : 50	50 : 50 50 : 50

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location EE

Unit 1

Fuel Bit. Coal

Test No.	1	2	3	4	5	6	7
Test Type	Const. Air	Const. Comb.	Optimum	Optimum	Optimum	Optimum	Optimum
Test Load (10^3 lb/hr)	88	91	93	93	91	92	92
Excess O_2 (%)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
NO_x (ppm)*	218	207	200	170	212	207	178
NO (ppm)*	216	205	205	168	208	207	176
CO_2 dry (%)	9.6	9.6	9.6	9.6	9.7	9.7	9.7
CO (ppm)*	0	0	0	66	0	0	0
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	84	84	83			84	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	911	905	905	907	907	906	907
Final Stm Temp. (°F)	715	690	685	685	685	685	685
Combus. Air Temp. (°F)							
Stack Temp. (°F)	315	290	280	285	285	287	285
Fuel Flow (CF/hr)/(lb)*	108	76	77	77	77	77	
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	26	16	24	24	26	26	27
Furnace Pres. (in. H_2O)	1.0	0.9	0.1	0.1	0.1	0.1	0.1
Register (% open)	50 65 60 60	50 60 60 60	50 60 50 50	50 60 50 50	50 60 50 50	45 50 50 50	45

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel Natural Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)		[illegible]					[illegible]
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)							
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow (CF/Hr)x 10^3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	Ambient						
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 1

Fuel Natural Gas

Test No.	1[illegible]:2	1[illegible]:6					
Test Type	Air Reg.	Air Reg.					
Test Load (10^3 lb/hr)	83	83					
Excess O_2 (%)	3.6	3.6					
NO_x (ppm)*	340	192					
NO (ppm)*	198	196					
$(O)_2$ dry (%)	9.6	10					
CO (ppm)*	0	15					
HC (ppm)*	------	------					
SO_x (ppm)*	------	------					
SO_2 (ppm)*	------	------					
Total Part. (lb/MBtu)	------	------					
Solid Part. (lb/MBtu)	------	------					
Boiler Efficiency (%)	------	83					
Smoke Spot No.	------	------					
Opacity (%)	------	------					
Final Stm Pres. (psig)	612	612					
Final Stm Temp. (°F)	708	708					
Combus. Air Temp. (°F)	------	------					
Stack Temp. (°F)	315	312					
Fuel Flow (CFH) x 10^3	108	108					
Fuel Temp. (°F)	Amb	Amb					
Fuel Pres. (psig)	28	28					
Furnace Pres. (in. H_2O)	-.1	-.1					
Register (% open)	40 : 40	40 : 40					

*at 3% O_2 dry

Bacharach Smoke No.
● Smoke × NO
□ □ ▲ NO2
Test No. 47-49
Test No. 1 Fuel Grade 6 Oil Inlet
Application No. 12 Load 62,000
CO, ppm
NOx, ppm
O2, %
Air - Gas Ratio Curves for Industrial Boilers as a Function of Excess Oxygen

Location 32
Unit + 6'
Test No. HC-18B

Test No.	Type of Test	Dry P_s	C_2H_2 / C_2H_4	C_2H_2 / C_2H_6	C_2H_2 / C_3H_8	C_2H_2 / C_3H_6	C_2H_2 / C_4H_{10}	H_2	CH_4 / H_2	C_2H_2	C_2H_4	C_2H_6	C_3H_8	Detector Signal	Detector Background	Orifice Meter Signal	Orifice Meter Background
101	Det.	34.52	4.36	0.33	0.063	0.035	0.035	–	0.35	0.33	0.37	0.65	0.725	0.0407	0.0388	1042
104-105	Det.	34.52	4.36	0.33	0.063	0.035	0.035	–	0.35	0.33	0.37	0.65	0.725	0.0407	0.0388	1042
105-106	Det.	34.52	2.00	0.40	[illegible]	–	–	–	0.20	–	0.45	–	0.786	0.0407	0.0388	976
106-107	Det.	34.11	4.33	0.68	0.15	0.04	0.03	–	0.47	–	3.36	0.84	0.765	0.0407	0.0371	1000
107-108	Det.	34.11	4.33	0.68	0.15	0.04	0.03	–	0.47	–	3.36	0.84	0.765	0.0407	0.0371	1000
108-109	Det.	33.8	3.84	0.51	0.08	0.01	0.01	–	–	–	–	–	0.730	0.0408	0.0376	1000
109-110	Det.	34.40	3.30	0.36	0.40	0.08	–	0.00	1.40	–	1.40	–	0.780	0.0407	0.0386	1000
110-111	Det.	33.81	4.27	0.71	–	–	–	0.20	0.78	–	–	–	0.722	0.0407	0.0388	1007
111-112	Det.	34.39	1.90	0.33	0.04	0.02	–	–	0.60	–	0.78	–	0.789	0.0408	0.0377	1001
112-113	Det.	33.36	1.62	0.27	0.06	–	–	–	0.37	0.01	0.78	–	0.795	0.0407	0.0376	1001
113-114	Det. + Rel.	48.42	20.96	1.48	0.23	0.03	–	35.47	–	0.02	2.48	–	0.576	0.0408	0.0355	981

INDUSTRIAL BOILER DESIGN DATA

Location No: 61 Test No: 100-A&C Unit No: 63

Unit Description 100 MW Integral Furnace, Air Supplied by 2 AP Axial Flow Gas Turbines at Forced Draft Fan

Installation Date	1985
Steam Output (10^3 lb/hr)	811
Design Pressure (psig)	932
Final Steam Temp (°F)	865
Furnace Type	Watertube
Furnace Size L-W-H (ft)	48'-32'-27'
Furnace Area (ft^2)	5250
Furnace Volume (ft^3)	30240
Burner Description	8 MBW Aspirated Spud Burners
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Refinery Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	850
Stack Temp (°F)	340

Comments: ⑫ ⑯ ⑦ ⑩ ① ③ ⑤ ⑭ Burner Arrangement

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location #3

Unit #2

Fuel Coal

Test No.	1	2	3	4	5	6	7
Test Type	Base Load	Excess Air	Excess Air	Base Load	Base Load	Base Load	Base Load
Test Load (10^3 lb/hr)	980	980	930	516	800	980	980
Excess O_2 (%)	5.1	5.2	8.1	3.8	10.3	5.6	5.7
NO_x (ppm)*	146	120	117	131	150	149	145
NO (ppm)*	138	114	111	125	124	142	139
O_2 dry (%)	8.4	9.2	8.4	10	8.2	9.2	9.4
CO (ppm)*	0	0	0	17	0	27	284
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	840		840	840	840	840	840
Final Stm Temp. (°F)	770		765	780	780	768	765
Combus. Air Temp. (°F)	675		670	675	675	650	640
Stack Temp. (°F)	390		375	385	360	395	
Fuel Flow (SCFH)	518,518			278,477	430,000	69,5000	670,000
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	21.2		18.8	25	9.0	25	26.8
Furnace Pres. (in. H_2O)	10.6		10.3	10.5	10	8.4	9.0
Register (% open)		same				same	same

*as % O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Refinery Gas

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)[a]							
NO (ppm)[a]							
$(O)_2$ dry (%)							
CO (ppm)[a]							
HC (ppm)[a]							
SO_x (ppm)[a]							
SO_2 (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow SCFH							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL FORM DATA

Location [illegible]

Unit [illegible]

Fuel Refinery Gas

Test No.	[illegible]	[illegible]					
Test Type	[illegible]	[illegible]					
Test Load (10^3 lb/hr)	[illegible]	[illegible]					
Excess O_2 (%)	[illegible]	[illegible]					
NO_x (ppm)[a]	[illegible]	[illegible]					
NO (ppm)[a]	[illegible]	[illegible]					
O_2 dry (%)	[illegible]	[illegible]					
CO (ppm)[a]	[illegible]	[illegible]					
HC (ppm)[a]	[illegible]	[illegible]					
SO_x (ppm)[a]	[illegible]	[illegible]					
SO_2 (ppm)[a]	[illegible]	[illegible]					
Total Part. (lb/MBtu)	[illegible]	[illegible]					
Solid Part. (lb/MBtu)	[illegible]	[illegible]					
Boiler Efficiency (%)	[illegible]	[illegible]					
Smoke Spot No.	[illegible]	[illegible]					
Opacity (%)	[illegible]	[illegible]					
Final Stm Pres. (psig)	[illegible]	[illegible]					
Final Stm Temp. (°F)	[illegible]	[illegible]					
Combus. Air Temp. (°F)	[illegible]	[illegible]					
Stack Temp. (°F)	[illegible]	[illegible]					
Fuel Flow (scfH)x10^3	[illegible]	[illegible]					
Fuel Temp. (°F)	Amb.	Amb.					
Fuel Pres. (psig)	[illegible]	[illegible]					
Furnace Pres. (in.H_2O)	[illegible]	[illegible]					
Register (% open)	[illegible]	[illegible]					

[a] at 3% O_2 dry

INDUSTRIAL BOILER DESIGN DATA

Location No: 89 Test No: 65-125 Unit No: 2

Unit Description Combustion Engr Wide A-Type Horizontal Boiler

Installation Date	1972
Steam Output (10^3 lb/hr)	250
Design Pressure (psig)	875
Final Steam Temp (°F)	825
Furnace Type	Watertube
Furnace Size L-W-H (ft)	40 - 12 - 0
Furnace Area (ft^2)	1200
Furnace Volume (ft^3)	4800
Burner Description	1 CE Cyclone Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	250
Stack Temp (°F)	710

Comments:

BOILER EMISSION MEASUREMENTS AND CONTROL MAIN DATA

Location 14

Unit 2

Fuel *Natural Gas*

Test No.	183-1	183-2	183-3	183-4	184-1	184-2	184-3
Test Type	Base	No Sec. Air	15% Air	Low Air	Final Reduced Sec. Air	Normal Air	Low Air
Test Load (10^3 lb/hr)	195	200	198	180	80	95	100
Excess O_2 (%)	2.6	2.6	5.2	9.3	10.8	5.7	3.8
NO_x (ppm)*	189	176	164	198	139	196	202
NO (ppm)*	182	171	159	196	137	191	193
O_2 dry (%)	11.4	11.4	9.0	9.2	8.2	9.2	10.1
CO (ppm)*	333	333	23	22	34	91	88
HC (ppm)*	41	----	----	61	857	999	168
SO_x (ppm)*	----	----	----	----	----	----	----
SO_2 (ppm)*	----	----	----	----	----	----	----
Total Part. (lb/MBtu)	----	----	----	----	----	----	----
Solid Part. (lb/MBtu)	----	----	----	----	----	----	----
Boiler Efficiency (%)	----	----	----	----	----	----	----
Smoke Spot No.	----	----	----	----	----	----	----
Opacity (%)	----	----	----	----	----	----	----
Final Stm Pres. (psig)	875	866	853	847	865	865	870
Final Stm Temp. (°F)	825	825	800	810	830	830	825
Combus. Air Temp. (°F)	210	215	200	238	230	230	230
Stack Temp. (°F)	710	705	675	668	610	630	645
Fuel Flow (cf/hr) x 10^3	252	254	195	190	100	126	142
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)	24.5	24.5	15	14.8	6	9	11
Furnace Pres. (in. H_2O)	16.5	16.4	15.2	14.0	7.5	8.7	11
Register (% open)	45-60	45-60	45-60	45-60	45-60	45-60	45-60

*at 15 O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel Natural Gas

Test No.							
Test Type	Normal Air	Low Air	Low Air	Low Air	Low Air	Air Htrs	Air Htrs
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)*							
NO (ppm)*							
CO_2 dry (%)							
CO (ppm)*							
HC (ppm)*							
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow (cfh) $\times 10^3$							
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL NORM DATA

Location [illegible]

Unit [illegible]

Fuel Natural Gas

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)[a]							
SO_3 (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow CFH x 10^3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]						
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open) [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location #4

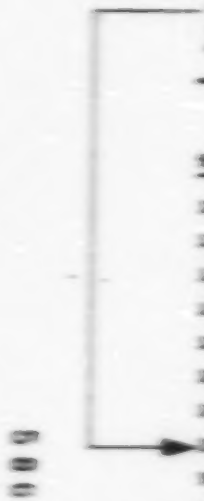
Unit #

Fuel Natural Gas

Test No.	10-2-1	10-2-2	10-2-3	10-2-10	10-2-11		
Test Type	Air Rich	Air Rich	Air Rich	Air Rich	Air Rich		
Test Load (10^3 lb/hr)	149	135	90	80	105		
Excess O_2 (%)	9.9	5.5	6.1	9.9	9.8		
NO_x (ppm)*	127	136	139	112	100		
NO (ppm)*	125	133	138	109	136		
O_2 dry (%)	9.2	8.5	8.2	7.2	8.9		
CO (ppm)*	20	0	18	0	17		
HC (ppm)*	50	20	0	0	0		
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	846	845	845	845	847		
Final Stn Temp. (°F)	791	795	810	800	780		
Combus. Air Temp. (°F)	83	78	80	80	82		
Stack Temp. (°F)	665	652	625	610	650		
Fuel Flow (FH x 10^3	185	180	134	98	152		
Fuel Temp. (°F)	Amb.				▸		
Fuel Pres. (psig)	14.5	12	8.8	6	10.5		
Furnace Pres. (in. H_2O)	11.5	10	8.5	8.5	8.2		
Register (% open)	35-65	35-65	35-65	35-65	65-65		
Primary-Secondary							

*at 3% O_2 dry

Location 3a
Unit 2
Test #6. 653-655'



Test No.	Type of Test	P_{ch}	C_{ch}	C_{ch}	E_{ch}	C_{ch}	C_{ch}	h_1	h_2	h_3	h_4	h_5	Gauges		Other	

INDUSTRIAL BOILER DESIGN DATA

Location No. 55 Test No. 55-100 Unit No. 6

Unit Description Erie City Iron Works Furnace with Traveling Grate

Installation Date	1950
Steam Output (10^3 lb/hr)	215
Design Pressure (psig)	275
Final Steam Temp (°F)	475
Furnace Type	Waterwall
Furnace Size L-W-H (ft)	19-22-43
Furnace Area (ft^2)	4285
Furnace Volume (ft^3)	18254
Burner Description	4 CE Stokers with Traveling Grate
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Coal
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	225
Stack Temp (°F)	290

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 56

Unit 6

Fuel Coal

Test No.	166-1	166-2	166-3	166-1	166-2	166-3	166-4
Test Type	Boiler	Low Air	Low Air	Low Air	Low Air	Low Air	Low Air
Test Load (10^3 lb/hr)	104	105	107	100	95	106	105
Excess O_2 (%)	9.5	9.5	9.6	9.0	8.5	8.8	8.7
NO_x (ppm)*	164	171	170	122	130	140	141
NO (ppm)*	108	107	107	121	128	139	134
CO_2 dry (%)	9.2	9.0	9.2	9.6	9.6	9.0	10.3
CO (ppm)*	51	28	59	90	170	47	80
HC (ppm)*	41	16	25	88	95	58	67
NO_x (ppm)*							
NO_2 (ppm)*							
Total Part. (lb/MBtu)	0.01			0.070			
Solid Part. (lb/MBtu)	0.01			0.063			
Boiler Efficiency (%)	76			76			78
Smoke Spot No.	7		9	7	8	9	8
Opacity (%)	25		25		30		
Final Stm Pres. (psig)	795	842	795	820	850	810	840
Final Stm Temp. (°F)	875	892	860	885	861	887	885
Combus. Air Temp. (°F)	230	217	210	235	235	230	230
Stack Temp. (°F)	292	285	278	290	295	290	290
Fuel Flow #/hr	20,820	23,458		20,820			
Fuel Temp. (°F)	Ambi						
Fuel Press. (psig)							
Furnace Pres. (in. H_2O)	-0.1	0	P.O.E	-0.13	-0.19	-0.2	-0.15
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 15

Unit 6

Fuel Coal

Test No.	66-5	66-6	66-7	66-8	67-1	67-2	67-3
Test Type	Hi Air	Low Air	Low Air	Low Air	Normal Air	Hi Excess	Normal Air
Test Load (10^3 lb/hr)	105	105	107	110	98	120	68
Excess O_2 (%)	10.9	8.8	8.4	8.2	9.4	8.3	11.3
NO_x (ppm)*	154	137	127	158	147	155	173
NO (ppm)*	153	135	134	152	146	152	172
CO_2 dry (%)	8.2	9.8	10	10.4	9.0	10	7.7
CO (ppm)*	36	87	114	50	23	100	28
HC (ppm)*		23	76	51	39	24	46
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)						77	
Smoke Spot No.			9	9	8	9	9
Opacity (%)			25	30	15		
Final Stm Pres. (psig)	860	820	820	870	810	780	800
Final Stm Temp. (°F)	885	850	875	901	865	980	891
Combus. Air Temp. (°F)	230	217	218	230	250	212	221
Stack Temp. (°F)	285	288	285	290	290	280	287
Fuel Flow							
Fuel Temp. (°F)	Amb.						
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)	-0.1	0	+0.05		-0.04	-0.1	-0
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 85

Unit 6

Fuel Coal

Test No.	85-9	85-1	85-2	85-3	85-4	85-5
Test Type	Low load	OFA	OFA	SOFA	OFA	Control Air
Test load (10^3 lb/hr)	50	95	107	102	95	105
Excess O_2 (%)	12.5	9.9	8.5	9.0	10.3	9.4
NO_x (ppm)*	239	158	150	160	174	169
NO (ppm)*	236	157	147	163	173	167
O_2 dry (%)	7.0	9.4	9.6	9.0	8.6	9.4
CO (ppm)*	74	24	36	23	8	31
HC (ppm)*	109	25	53	39	65	191
SO_x (ppm)*						
SO_2 (ppm)*						
Total Part. (lb/MBtu)						
Solid Part. (lb/MBtu)						
Boiler Efficiency (%)	74			76		
Smoke Spot No.	9	8.5	9	9	9	
Opacity (%)						20
Final Stm Pres. (psig)	870	895	820	870	800	890
Final Stm Temp. (°F)	715	885	810	870	770	865
Combus. Air Temp. (°F)	290	280	285	280	290	285
Stack Temp. (°F)	285	290	290	295	290	285
Fuel Flow						
Fuel Temp. (°F)	Amb					"
Fuel Pres. (psig)						
Furnace Pres. (in. H_2O)	-.10	0	-.09	-.07	0	-.09
Register (% open)						

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.	166-3	166-5	166-6	166-8
Location No.	35	35	35	35
Fuel Type	Coal	"	"	"
Burner Type	Circular	"	"	"
Feed Load (lb/hr x 10^3)	106	105	105	110
Stack Temp (°F)	320	320	320	320
Stack Press. (in.H_2O)	0.27	0.27	0.27	0.27
Impactor ΔP (in.H_2O)	20.14	19.87	20.14	20.28
Gas Volume (cm^3)	88,560	157,080	132,780	142,440
Impactor Flow ($cm^3 \cdot s^{-1}$)	294.6	305.2	296.6	296.6
Sample Time (sec)	3600	7,200	5,400	5,400
Orientation	Horizontal	"	"	"
D_{50} Cyclone (μm)	15.0	16.8	14.7	15.8
Stage 1 (μm)	3.8	3.6	3.4	3.5
Stage 2 (μm)	1.1	1.0	0.90	0.91
Stage 3 (μm)	1.2	1.0	1.4	1.4
Stage 4 (μm)	0.7	0.73	0.68	0.71
Stage 5 (μm)	0.35	0.38	0.35	0.35
Cyclone (mg)	10.89	9.05	8.01	15.01
Stage 1 (mg)	1.038	0.69	0.68	2.02
Stage 2 (mg)	0.780	0.75	0.52	0.6
Stage 3 (mg)	0.66	1.78	1.01	1.38
Stage 4 (mg)	0.34	0.70	1.33	1.21
Stage 5 (mg)	0.60	3.00	0.76	0.72
Filter (mg)	0.530	3.91	1.74	1.22
Total Catch (mg)	14.60	19.88	13.87	23.04
Comments	Blockage in small diameter	Small diameter	Small diameter	Small diameter

CASCADE IMPACTOR DATA

Test No.	168-8	(168-9)	(168-10)	
Location No.	S5	S5	S5	
Fuel Type	Coal	"	"	
Burner Type	Circular	"	"	
Test Load (lb/hr x 10^3)	97	100.5	110	
Stack Temp (°F)	305	305	320	
Stack Press. (in.H_2O)	0.07	0.07	0.07	
Impactor ΔP (in.H_2O)	0.75	0.75	0.75	
Gas Volume (cm^3)	127,400	130,140	130,140	
Impactor Flow ($cm^3 \cdot s^{-1}$)	23.6	24.1	24.1	
Sample Time (sec)	5,400	5,400	5,400	
Orientation	Horizontal	"	"	
D_{50} Cyclone (μm)	10.3	10.0	10.0	
Stage 1 (μm)	3.5	3.5	3.5	
Stage 2 (μm)	2.1	2.1	2.1	
Stage 3 (μm)	1.4	1.4	1.4	
Stage 4 (μm)	0.71	0.70	0.70	
Stage 5 (μm)	0.35	0.35	0.35	
Cyclone (mg)	10.85	19.99	34.10	
Stage 1 (mg)	0.000	3.30	0.760	
Stage 2 (mg)	0.370	1.01	3.42	
Stage 3 (mg)	0.435	0.936	0.58	
Stage 4 (mg)	0.10	0.092	1.20	
Stage 5 (mg)	3.26	1.309	1.88	
Filter (mg)	1.09	1.09	1.95	
Total Catch (mg)	16.92	31.48	43.93	
Comments	Spoon 40% 60% sand distribution	with sand distribution	with sand distribution	

Backbrush Smoke No.

NO, ppm

CO, ppm

NO, ppm

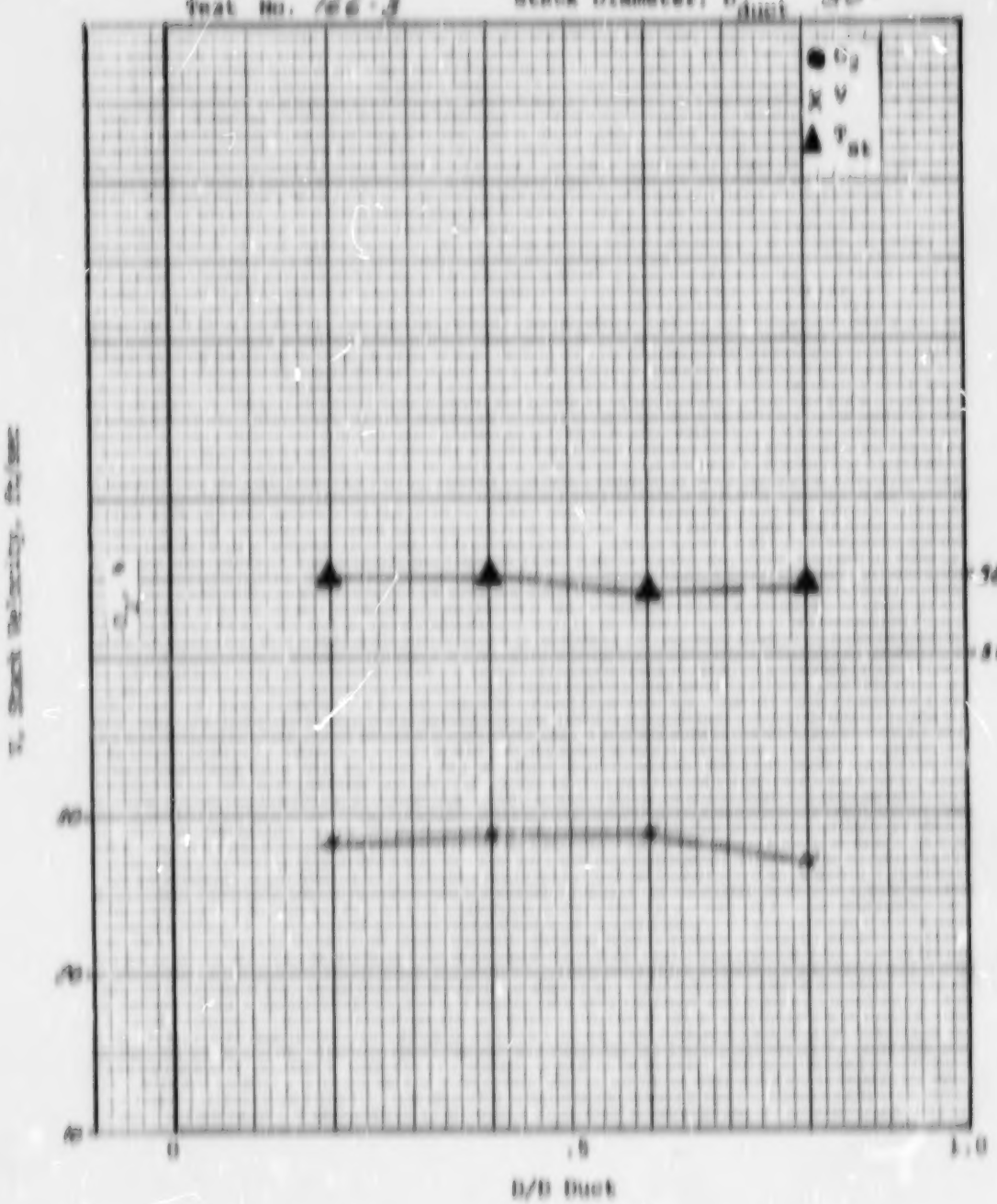
Emissions for Intermittent Backbrush as a Function of Excess Oxygen

STACK TRAVERSE DATA

Location No. *S5* Fuel *Coal*

Unit No. *6* Load *100,000* lb/hr

Test No. *66-A* Stack Diameter, D_{duct} *40"*



Location 35
Unit 6
Test #6 (EC-169)

FUEL ANALYSIS SUMMARY

Coal and Oil Fuels

Test no.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Gasoline Reactivity, Octane No.	Gravity, °API	Higher Heating Value Btu/lb	Btu/lb
102–103	#2 Oil	85.96	12.72	0.89	0.40	0.045	0.003	–	8.671	31.1	0.0452	19,440
107–108	#2 Oil	85.96	12.72	0.89	0.40	0.045	0.003	–	8.671	31.1	0.0452	19,440
111–113	#6 Oil (#5 Oil)	86.46	10.31	1.07	1.29	0.77	0.13	–	8.55	15.1	0.0426	18,333
116–121	#6 Oil	85.65	10.23	0.22	2.74	0.31	0.65	–	–	–	0.0423	18,213
126–131	#6 Oil	No Fuel Sample Obtained For Analysis										
133–138	Coal	62.54	5.31	12.52	1.15	0.83	10.5	7.29	–	–	0.0276	11,863
134–139	Coal	68.38	4.78	11.81	1.16	1.46	9.71	3.66	–	–	0.0286	12,293
136–159	Coal	69.89	4.67	8.38	1.36	1.58	14.48	3.37	–	–	0.0286	12,346
159	#6 Oil	85.44	11.35	0.802	2.80	0.33	0.078	–	12.33	15.8	0.0432	18,580
160–164	#2 Oil	87.14	12.71	–	0.31	0.013	<0.001	–	8.827	35.1	0.0451	19,390
165–168	Coal	63.42	4.88	9.85	3.05	0.94	13.7	4.15	46.2	–	0.0276	11,873
169	Coal	62.50	5.11	12.51	1.15	0.83	10.5	7.29	–	–	0.0276	11,863
170–175	#6 Oil	85.69	10.94	0.31	1.43	0.30	0.25	–	9.10	15.1	0.0434	18,660
176–179	#6 Oil	86.17	10.55	–	1.91	0.30	0.47	–	–	–	0.0436	18,773
180–189	#6 Oil	85.10	11.10	1.12	0.79	0.49	0.08	–	8.53	25.7	0.0446	19,227
195–206	#6 Oil	86.68	12.16	0.65	0.37	0.14	0.009	–	1.61	29.2	0.0450	19,365

INDUSTRIAL BOILER DESIGN DATA

Ignition No. 36 Test No. 80-84 Unit No. 6

Unit Description 84" Package Boiler FM-14-117 with NOx Port

Installation Date	1971
Steam Output (10^3 lb/hr)	200
Design Pressure (psig)	150
Final Steam Temp (°F)	367
Furnace Type	Watertube
Furnace Size L-W-H (ft)	35-7-10
Furnace Area (ft^2)	1260
Furnace Volume (ft^3)	2450
Burner Description	Steam Atom. Circular Dual Register Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#2 Oil
Fuel Temp at Burner (°F)	Ambient
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	340

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 36

Unit 6

Fuel #6 Oil

Test No.	160-1	160-2	160-3	160-4	160-5	160-6	160-7
Test Type	Base	Normal Air	Low Air	Normal Air	Normal Air	Normal Air	Coal Load
Test Load (10^3 lb/hr)	68	60	70	70	62	60	36
Excess O_2 (%)	4.4	6.8	3.3	3.6	5.0	6.6	7.5
NO_x (ppm)*	103	78	104	93	88	89	102
NO (ppm)*	102	96	101	92	86	87	100
CO_2 dry (%)	11.2	9.8	12.9	12.4	11.0	11.3	7.9
CO (ppm)*	0	0	0	0	9	10	0
HC (ppm)*	0	0	0	0	9	0	0
NO_R (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)	0.027						
Solid Part. (lb/MBtu)	0.016						
Boiler Efficiency (%)	86						
Smoke Spot No.	0	0	4	2	0	1	
Opacity (%)							
Final Stm Pres. (psig)	106	106	106	108	111	104	114
Final Stm Temp. (°F)	835	832	830	830	824	832	
Combus. Air Temp. (°F)	92	82	83	83	92	80	
Stack Temp. (°F)	330	325	290	330	290	300	215
Fuel Flow							
Fuel Temp. (°F)	Ambient						
Fuel Pres. (psig)	52	52	35	52	50	50	10
Furnace Pres. (in. H_2O)	0.5	0.5	.1	0.25	0.25	0.5	0
Register (% open)	Normal						

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location 56

Unit 6

Fuel #2 0.1

Test No.	56-1	56-2	56-3	56-4	56-5	56-6	56-7
Test Type	Normal Air	RCA	RCA	RCA	Normal Air	Low Air	RCA
Test Load (10^3 lb/hr)	60	60	60	59	76	77	76
Excess O_2 (%)	5.1	5.6	5.4	5.5	3.7	2.5	2.8
NO_x (ppm)*	103	96	98	103	99	108	97
NO (ppm)*	102	95	97	102	98	107	96
$(O)_2$ dry (%)	10.6	10.6	10.6	10.6	12.2	13.8	13.4
CO (ppm)*	0	0	0	0	0	10	20
HC (ppm)*	0	0	0	0	0	5	5
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			85	84			85
Smoke Spot No.		0			6	5	4
Opacity (%)							
Final Stm Pres. (psig)	108	107	108	109	105	108	105
Final Stm Temp. (°F)	334	334	334	334	331	331	331
Combus. Air Temp. (°F)	72	73	73	72	84	86	88
Stack Temp. (°F)	335	333	332	340	336	336	331
Fuel Flow							
Fuel Temp. (°F)	Ambient						"
Fuel Pres. (psig)	22	22	22	22	29	30	32
Furnace Pres. (in. H_2O)	0.6	0.5	0.5	0.5	0.5	0.20	0.21
Register (% open)	Normal						"

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL BOOK DATA

Location 56

Unit 6

Fuel #2 Oil

Test No.	161-8	161-9	161-10	161-11	161-12	162-1	162-2
Test Type	90%	Hi Air	Low Load	Low Load	Low Air	Normal Air	Normal Air
Test Load (10^3 lb/hr)	78	80	57	56	56	76	78
Excess O_2 (%)	3.3	4.7	7.1	7.4	9.0	5.6	5.9
NO_x (ppm)*	109	114	77	100	108	131	87
NO (ppm)*	108	133	76	99	105	128	85
O_2 dry (%)	15.4	11.8	8.6	8.0	8.6	10.8	10.4
CO (ppm)*	14	11	0	0	0	0	0
HC (ppm)*	0	0	0	0	0	0	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	85						
Smoke Spot No.	4	2	0	0	0.1	0	0
Opacity (%)							
Final Stm Pres. (psig)	105	105	102	102	102	105	104
Final Stm Temp. (°F)	331	331	331	331	331	131	331
Combus. Air Temp. (°F)	86	86	87	86	88	88	87
Stack Temp. (°F)	330	330	280	280	280	330	331
Fuel Flow							
Fuel Temp. (°F)	Ambient						"
Fuel Pres. (psig)	31	31	10	10	10	30	30
Furnace Pres. (in. H_2O)	0.05	0.3	0.1	0	0	0.2	0.2
Register (% open)	Normal						"

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS

AND CONTROL ROOM DATA

Location Sc

Unit 6

Fuel Pet C.C.

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Test Load (10^3 lb/hr)	90	90	88	53	52	90	60
Excess O_2 (%)	4.9	5.5	5.8	7.0	6.7	4.3	5.5
NO_x (ppm)*	124	85	81	74	72	71	73
NO (ppm)*	102	81	79	72	70	69	73
CO_2 dry (%)	11.8	12.4	12.0	9.8	10	9.6	11.8
CO (ppm)*	0	0	0	0	0	0	0
HC (ppm)*	0	0	0	0	0	0	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	85		85				
Smoke Spot No.	3	4	3	0	2	2	3
Opacity (%)							
Final Stm Pres. (psig)	103	103	105	104	104	104	102
Final Stm Temp. (°F)	531	531	531	531	531	531	531
Combus. Air Temp. (°F)	89	84	86	89	89	91	88
Stack Temp. (°F)	346	346	346	300	301	300	279
Fuel Flow							
Fuel Temp. (°F)	Ambient						"
Fuel Pres. (psig)	35	36	36	18	18	18	20
Furnace Pres. (in. H_2O)	1.0	1.0	1.0	0.5	0.6	0.5	0.5
Register (% open)	Normal						"

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL SYSTEM DATA

Location 56

Unit 6

Fuel #6 Oil

Test No.	1	2	3	4			
Test Type	Steam Press.	Steam Press.	Steam Air	Steam Load			
Test Load (10^3 lb/hr)	55	52	62	50			
Excess O_2 (%)	5.9	5.8	6.2	5.1			
NO_x (ppm)*	95	89	91	83			
NO (ppm)*	94	86	90	81			
CO_2 dry (%)	11.1	10.6	10.2	12.0			
CO (ppm)*	31	0	0	23			
HC (ppm)*	0	0	0	0			
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	85	85		85			
Smoke Spot No.	0	0	0	1			
Opacity (%)							
Final Stm Pres. (psig)	105	105	111	104			
Final Stm Temp. (°F)	331	331	334	331			
Combus. Air Temp. (°F)	69	72	72	68			
Stack Temp. (°F)	300	298	300	300			
Fuel Flow							
Fuel Temp. (°F)	Ambient			"			
Fuel Pres. (psig)	80	79	80	80			
Furnace Pres. (in. H_2O)	0.15	0.25	0.25	1.0			
Register (% open)	Varied			"			

*at 3% O_2 dry

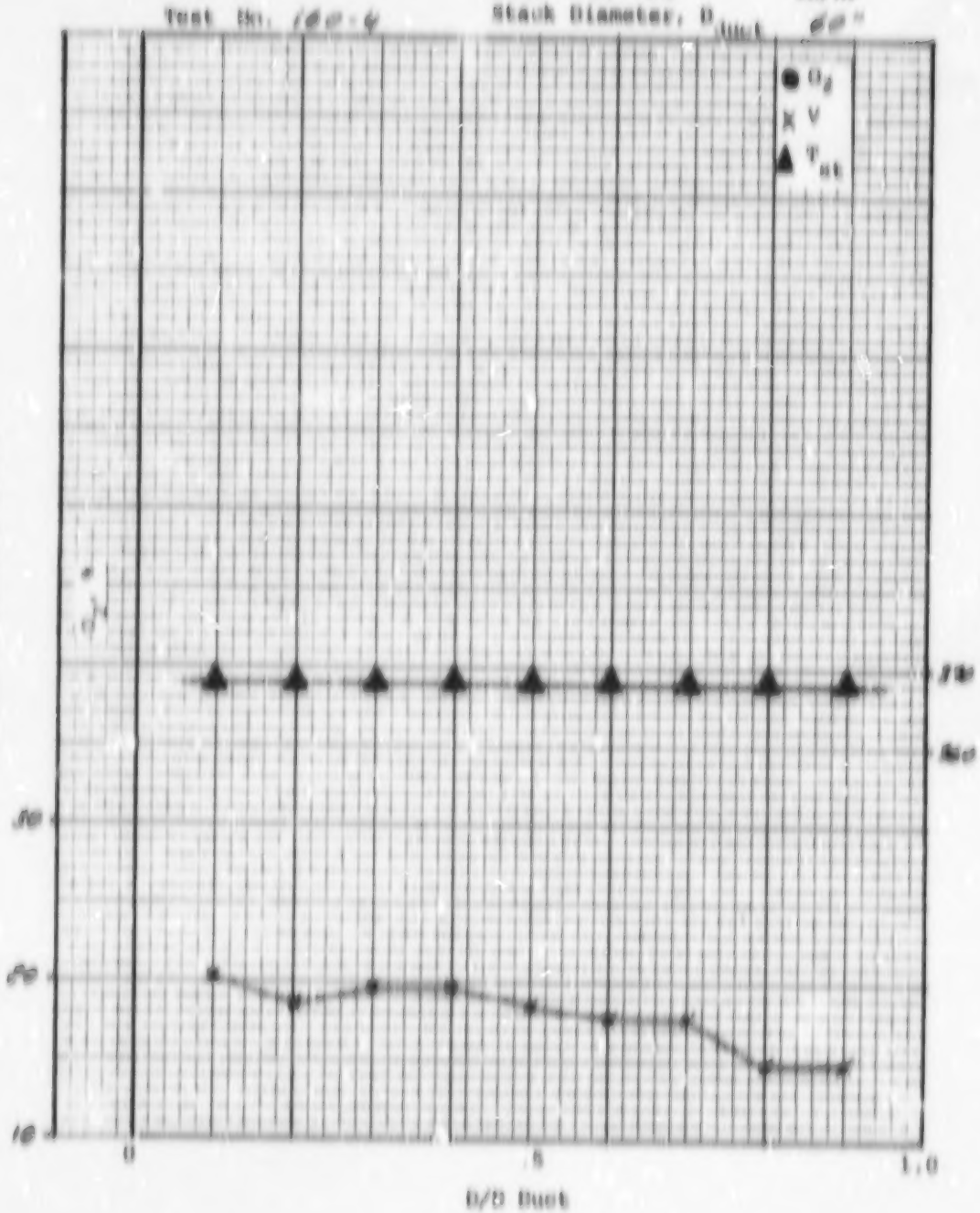
CASCADE IMPACTOR DATA

Test No.		100-5	100-4	100-3R	
Location No.		56	56	56	
Fuel Type		#2 Oil	#2 Oil	#2 Oil	
Burner Type		Steam	Steam	Steam	
Test Load ($lb/hr \times 10^3$)		55	61	61	
Stack Temp (°F)		315	312	312	
Stack Press. ($in.H_2O$)		0.2	0.2	0.2	
Impactor ΔP ($in.H_2O$)		27.1	27.7	27.1	
Gas Volume (cm^3)		24 9512	580,716	580,716	
Impactor Flow ($cm^3 \cdot s^{-1}$)		28.3	28.3	28.3	
Sample Time (sec)		8640	20,520	20,520	
Orientation		Horizontal	←	←	
D_{50} Cyclone (μm)		———	———	———	
Cascade Impactor Stage Cut Points	1 (μm)	3.2	3.2	3.2	
	2 (μm)	1.9	1.9	1.9	
	3 (μm)	1.3	1.3	1.3	
	4 (μm)	0.64	0.64	0.64	
	5 (μm)	0.32	0.32	0.32	
Cascade Impactor Catch	Cyclone (mg)	None	None	None	
	Stage 1 (mg)	96.9	5.00	10.00	
	Stage 2 (mg)	7.65	0.148	3.57	
	Stage 3 (mg)	0.408	0.064	0.788	
	Stage 4 (mg)	0.756	1.052	0.62	
	Stage 5 (mg)	0.008	0.024	0.034	
	Filter (mg)	0.368	0.192	0.00	
Total Catch (mg)		107.6	7.06	15.06	
Comments		Lower Team	Low Flow	Blocking	

STACK TRAVERSE DATA

Location No. 06
Unit No. 6
Test No. 10-4

Fuel #2 oil
Load 700,000 lb/hr
Stack Diameter, D_{duct} 40"



Location 36
Unit 6
Test 66 150 - 164

FUEL ANALYSIS SUMMARY

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, C, %	Hydrogen, H, %	Oxygen, O, %	Nitrogen, N, %	Sulfur, S, %	Ash, %	Moisture, %	Moisture, Residue, %	Volatility, % Air	Higher Heating Value Btu/lb	Higher Heating Value Btu/lb
101--103	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
107-108	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	-	0.071	31.1	0.0452	19,440
111-112	PS 300 (85 Oil)	86.46	10.31	1.07	1.29	0.77	0.10	-	0.50	15.1	0.0435	18,333
116-121	#6 Oil	85.95	10.21	0.22	2.74	0.31	0.03	-	-	-	0.0423	18,213
126-130	#6 Oil	No Fuel Sample Obtained For Analysis										
130-133	Coal	62.50	5.21	12.51	1.15	0.83	10.5	7.29	-	-	0.0276	11,863
134-139	Coal	68.30	4.70	11.01	1.16	1.46	9.71	3.66	-	-	0.0286	12,293
156-159	Coal	69.89	4.67	8.10	1.36	1.58	14.48	3.37	-	-	0.0286	12,300
155	#6 Oil	85.44	11.35	0.002	2.98	0.33	0.078	-	12.33	15.8	0.0432	18,580
160-164	#2 Oil	87.14	12.71	-	0.31	0.013	<0.001	-	0.027	35.1	0.0451	19,390
165-168	Coal	63.42	4.84	9.85	1.05	0.94	13.7	4.15	46.2	-	0.0276	11,873
169	Coal	62.50	5.12	12.51	1.15	0.83	10.5	7.29	-	-	0.0276	11,863
170-175	#6 Oil	86.60	10.94	0.31	1.68	0.38	0.25	-	9.68	15.1	0.0434	18,660
176-179	#6 Oil	86.17	11.55	-	1.95	0.38	0.07	-	-	-	0.0436	18,773
184-189	#6 Oil	85.10	11.10	3.12	0.19	0.49	0.08	-	8.53	25.7	0.0446	19,227
195-206	#6 Oil	86.68	12.16	0.65	0.37	0.14	0.079	-	1.62	78.2	0.0450	19,365

INDUSTRIAL BOILER DESIGN DATA

Location No. 37 Test No. 178 - 179 Unit No. 2

Unit Description Wickes Boiler No. 5497

Installation Date	1955
Steam Output (10^3 lb/hr)	90
Design Pressure (psig)	150
Final Steam Temp (°F)	373
Furnace Type	Watertube
Furnace Size L-W-H (ft)	42 - 12 - 42
Furnace Area (ft^2)	997
Furnace Volume (ft^3)	1490
Burner Description	2 Peabody steam Atom. Oil Burners
Horiz. Burner Spacing (ft)	8.00
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	189
Primary Air Temp (°F)	280
Stack Temp (°F)	425

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location S7

Unit 7

Fuel #6 Oil

Test No.	176-1	176-2	176-3	176-4	176-5	176-6	176-7
Test Type	Coal/Oil Air	Moist	Coal/Oil Air	Coal/Oil Air	Coal/Oil Air	Coal/Oil Air	Coal/Oil Air
Test Load (10^3 lb/hr)	32	32	316	324	315	28	321
Excess O_2 (%)	4.0	4.3	4.0	4.3	4.6	4.4	4.0
NO_x (ppm)*	———	195	191	198	198	190	189
NO (ppm)*	———	193	189	193	192	188	186
CO_2 dry (%)	13.8	13.6	13.1	13.2	12	13.4	13.1
CO (ppm)*	0	0	0	0	2	0	16
HC (ppm)*	———	18	13	0	13	12	10
SO_x (ppm)*	———	1106	———	———	———	———	———
SO_2 (ppm)*	———	1090	———	———	———	———	———
Total Part. (lb/MBtu)	———	0.164	———	———	———	———	———
Solid Part. (lb/MBtu)	———	0.118	———	———	———	———	———
Boiler Efficiency (%)	———	85	———	———	———	———	———
Smoke Spot No.	———	5	———	5.6	———	———	———
Opacity (%)	———	———	———	———	5	———	———
Final Stm Pres. (psig)	150	144	145	150	146	144	142
Final Stm Temp. (°F)	Saturated						
Combus. Air Temp. (°F)	227	227	225	229	231	231	234
Stack Temp. (°F)	408	408	400	450	450	460	460
Fuel Flow GPH	———	218	2126	2018	2006	2045	221
Fuel Temp. (°F)	192	192	194	194	194	194	193
Fuel Pres. (psig)	———	80	73	74	75	73	60
Furnace Pres. (in. H_2O)	< -0.5	< -0.5	-0.19	-0.38	-0.3	-0.3	-0.37
Register (% open) Left, Right	———	50 - 50	50 - 50	50 - 50	50 - 50	50 - 50	50 - 50

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit 2

Fuel #6 Oil

Test No.	122-1	122-2	122-3	122-4	122-5	122-6	122-7
Test Type	VPH	VPH	VPH	VPH	VPH	VPH	VPH
Test Load (10^3 lb/hr)	314	314	311	301	308	309	311
Excess O_2 (%)	4.5	4.4	4.5	4.4	4.3	4.3	4.3
NO_x (ppm)*	191	194	186	187	189	192	186
NO (ppm)*	191	193	185	185	188	189	184
CO_2 dry (%)	11.8	12.8	12	11.9	11.9	12.1	12.6
CO (ppm)*	0	0	38	60	49	32	27
HC (ppm)*	15	30	16	12	6	12	6
SO_x (ppm)*	----	----	----	----	----	----	----
SO_2 (ppm)*	----	----	----	----	----	----	----
Total Part. (lb/MBtu)	----	----	----	----	----	----	----
Solid Part. (lb/MBtu)	----	----	----	----	----	----	----
Boiler Efficiency (%)	----	----	83	----	83	----	----
Smoke Spot No.	----	----	0	----	----	----	----
Opacity (%)	----	----	----	----	----	----	----
Final Stm Pres. (psig)	143	144	142	149	150	149	154
Final Stm Temp. (°F)	Saturated	----	----	----	----	----	←
Combus. Air Temp. (°F)	206	184	115	134	170	115	183
Stack Temp. (°F)	450	462	435	480	475	461	490
Fuel Flow GPH	266.7	273	267.7	266.4	271.6	264	265
Fuel Temp. (°F)	194	194	194	194	194	194	194
Fuel Pres. (psig)	71	70.5	75	70	72	73	74
Furnace Pres. (in. H_2O)	-0.48	-0.38	-0.25	-0.25	-0.3	-0.30	-0
Register (% open)	50-50	50-50	50-50	50-50	50-50	50-50	50-[illegible]

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL NOX DATA

Location [illegible]

Unit 2

Fuel #6 Oil

Test No.	177-8	178-1	178-2	178-3	179-1	179-5	179-8
Test Type	VDM	Viscosity	Viscosity	Viscosity	Test Air	M Air	M Air
Test Load (10^3 lb/hr)	3[illegible]5	31.7	33.8	32[illegible]5	32[illegible]5	32	31.7
Excess O_2 (%)	3.9	4.6	4.5	4.5	5.8	5.2	5.7
NO_x (ppm)*	185	191	194	194	179	196	201
NO (ppm)*	182	189	192	192	178	196	199
CO_2 dry (%)	11.8	11.5	11.8	12.0	12.6	11.6	11.6
CO (ppm)*	32	0	0	0	0	11	0
HC (ppm)*	0	30	0	0	0	0	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)			84				84
Smoke Spot No.		7					5.5
Opacity (%)							
Final Stm Pres. (psig)	155	148	146	145	138	146	144
Final Stm Temp. (°F)	Saturated						"
Combus. Air Temp. (°F)	198	231	252	254	231	258	250
Stack Temp. (°F)	490	458	460	453	457	460	460
Fuel Flow GPM	28.7	27.2	27.9	27.5	26.5	27.2	27.2
Fuel Temp. (°F)	194	177	190	194	194	194	194
Fuel Pres. (psig)	78	60	66	60	72	65.5	65.5
Furnace Pres. (in H_2O)	-0.1	-0.3	-0.3	-0.15	-0.15	-0.15	-0.17
Register is open)	50-50	50-50	50-50	50-50	50-50	50-50	50-50

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location S 7
Unit 2
Fuel #6 Oil

Test No.	124-4						
Test Type	Comb. Adj.						
Test Load (10^3 lb/hr)	32						
Excess O_2 (%)	4.0						
NO_x (ppm)*	174						
NO (ppm)*	173						
CO_2 dry (%)	12.1						
CO (ppm)*	26						
HC (ppm)*	0						
SO_x (ppm)*	----						
SO_2 (ppm)*	----						
Total Part. (lb/MBtu)	0.076						
Solid Part. (lb/MBtu)	0.081						
Boiler Efficiency (%)	85						
Smoke Spot No.	7						
Opacity (%)	5						
Final Stm Pres. (psig)	146						
Final Stm Temp. (°F)	Sat'd						
Combus. Air Temp. (°F)	84						
Stack Temp. (°F)	453						
Fuel Flow GPM	27.3						
Fuel Temp. (°F)	198						
Fuel Pres. (psig)	65.5						
Furnace Pres. (in. H_2O)	-0.5						
Registers (% open)	50 - 50						

*at 3% O_2 dry

CASCADE IMPACTOR DATA

Test No.		136-5	137-4		
Location No.		37	37		
Fuel Type		#6 Oil	#6 Oil		
Burner Type		Steam Atom	"		
Test Load (lb/hr x 10^3)		32.5	32		
Stack Temp (°F)		426	418		
Stack Press. (in.H_2O)		9.4	10.5		
Impactor ΔP (in.H_2O)		3.4	3.7		
Gas Volume (cm^3)		24,500,000	22,700,000		
Impactor Flow ($cm^3 \cdot s^{-1}$)		2216	2297		
Sample Time (sec)		11,000	9,900		
Orientation		Horizont.	Horizont.		
D_{50} Cyclone (μm)		———	———		
Particle Size Distribution	1 (μm)	3.02	3.61		
	2 (μm)	2.12	2.17		
	3 (μm)	1.45	1.44		
	4 (μm)	0.72	0.78		
	5 (μm)	0.36	0.36		
Catch (mg)	Cyclone (mg)	None	None		
	Stage 1 (mg)	2.862	3.112		
	Stage 2 (mg)	1.010	1.372		
	Stage 3 (mg)	0.668	0.876		
	Stage 4 (mg)	0.456	0.382		
	Stage 5 (mg)	0.312	0.170		
	Filter (mg)	2.700	2.544		
Total Catch (mg)		8.008	8.456		
Comments		Blowing	Blow Back		

Bacharach Smoke No.
0
0
● Smoke
C O
× NC
▲ NC
Relationship for Industrial Boilers as a Function of Excess Oxygen
O_2, %
NO$_x$, ppm
CO, ppm

Location 37
Unit 2
Test No. 176 - 179

[illegible] Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Volatile Combustible, %	Fixed Carbon, %	Higher Heating Value Btu/lb	Higher Heating Value Btu/lb
103-103	#2 Oil	85.94	13.73	0.29	0.40	0.045	0.003	-		0.071	31.1	0.0452	19,440
107-109	#2 Oil	85.94	13.72	0.29	0.40	0.045	0.002	-		0.071	31.1	0.0452	19,440
111-113	#6 300 (85 Oil)	86.45	10.31	1.07	1.29	0.77	0.10	-		0.50	15.1	0.0426	18,333
116-121	#6 Oil	85.95	10.31	0.33	2.74	0.31	0.03	-	-	-		0.0423	19,213
126-130	#6 Oil	No Fuel Sample Obtained For Analysis											
131-133	Coal	62.50	5.21	12.51	1.15	0.83	10.5	7.29	-	-		0.0276	11,863
134-139	Coal	68.30	4.70	11.01	1.16	1.46	9.71	3.66	-	-		0.0266	12,293
156-159	Coal	69.85	4.67	8.30	1.36	1.52	14.48	3.37	-	-		0.0256	12,359
159	#6 Oil	85.44	11.35	0.402	2.88	0.35	0.078	-		0.33	15.8	0.0412	18,580
160-164	#2 Oil	87.14	12.71	-	0.31	0.013	<0.001	-		0.027	35.1	0.0451	19,395
165-168	Coal	63.42	4.84	9.85	1.05	0.94	13.7	4.35	46.2	-		0.0276	11,873
169	Coal	62.50	5.12	12.51	1.15	0.83	10.5	7.29	-	-		0.0276	11,863
170-175	#6 Oil	86.60	10.94	0.31	1.60	0.38	0.25	-		0.80	15.1	0.0434	18,680
176-179	#6 Oil	86.17	11.55	-	1.61	0.38	0.07	-	-	-		0.0436	18,773
186-189	#6 Oil	85.10	11.19	3.13	0.19	0.40	0.09	-		0.53	35.7	0.0446	19,227
195-206	#6 Oil	86.48	12.16	0.65	0.37	0.14	0.009	-		1.61	35.2	0.0450	19,365

A-10

INDUSTRIAL BOILER DESIGN DATA

Location No. 38 Test No. 150-155 Unit No. 2

Unit Description CE - Boiler

Installation Date	1951
Steam Output (10^3 lb/hr)	45
Design Pressure (psig)	
Final Steam Temp (°F)	
Furnace Type	Watertube
Furnace Size L-W-H (ft)	11'-6" - 15"
Furnace Area (ft^2)	66.9
Furnace Volume (ft^3)	1000
Burner Description	1 Peabody Ring Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural Gas
Fuel Temp at Burner (°F)	
Primary Air Temp (°F)	350
Stack Temp (°F)	440

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location SB

Unit 8

Fuel Natural Gas

Test No.	180-8	181-8	181-9	182-9	182-12	183-00	183-01
Test Type	Base	15% Air	Soot Blow	HPH	HPH	SCA	SCA
Test Load (10^3 lb/hr)	40	40	40	40	38	40	39
Excess O_2 (%)	1.9	3.2	1.9	1.8	1.6	1.9	2.0
NO_x (ppm)*	252	283	182	236	179	161	148
NO (ppm)*	216	236	180	232	149	137	101
$(O)_2$ dry (%)	9.9	9.8	9.9	9.8	9.8	8.8	8.9
CO (ppm)*	0	0	900	30	30	60	50
HC (ppm)*	10	60	0	10	0		
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	82	81	83	81	79	80	79
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL RUN DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]			
Test Type	[illegible]	[illegible]	[illegible]	[illegible]			
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]			
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]			
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]			
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]			
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]			
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]			
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]			
SO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]			
SO_2 (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]			
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]			
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]			
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]			
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]			
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]			
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]			
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Flow	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]			
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]			
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]			
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]			

[a] at 3% O_2 dry

Location 38
Unit 2
Test No. 180 - 185

Test No.	Type of Gas	N_2 %	C_3H_8 %	C_4H_{10} %	C_5H_{12} %	C_6H_{12} %	C_6H_{14} %	H_2 %	CO_2 %	H_2S %	O_2 %	H_2O %	Density kg/m³	Density lb/ft³	Wobbe Number kcal/m³	Wobbe Number Btu/ft³
180	Nat.	96.50	0.24	0.08	0.062	0.010	0.002	–	0.35	0.12	0.37	0.05	0.726	0.04477	0.10268	1142
180-184	Nat.	96.50	0.24	0.08	0.062	0.010	0.002	–	0.35	0.12	0.37	0.05	0.726	0.04477	0.10268	1142
180-183	Nat.	96.88	0.01	0.00	Trace	–	–	–	0.35	–	0.00	–	0.706	0.04345	0.10024	976
180-185	Nat.	96.31	0.31	0.00	0.15	0.04	0.02	–	0.47	–	0.96	0.04	0.722	0.04472	0.10273	1000
180-185	Nat.	96.31	0.31	0.00	0.15	0.04	0.02	–	0.47	–	0.96	0.04	0.722	0.04472	0.10273	1000
180-186	Nat.	96.0	0.04	0.01	0.00	0.01	0.01	–	–	–	–	–	0.720	0.04460	0.10251	1000
180-182	Nat.	96.40	0.30	0.10	0.00	–		0.00	0.40	–	0.00	–	0.722	0.04472	0.10268	1000
180-181	Nat.	96.00	0.37	0.12	–	–	–	0.00	0.70	–	–	–	0.722	0.04472	0.10268	1000
180-180	Nat.	96.50	0.30	0.10	0.00	0.01	–	–	0.40	–	0.00	–	0.722	0.04472	0.10268	1000
180-184	Nat.	97.30	0.00	0.00	0.00	–	–	–	0.37	0.00	0.00	–	0.706	0.04370	0.10041	1000
180-183	Nat. – Nat.	96.40	0.00	0.00	0.00	0.00	–	0.00	–	0.00	0.00	–	0.726	0.04500	0.10334	1000

INDUSTRIAL BOILER DESIGN DATA

Location No. 38 Test No. 488 - 489 Unit No. 2

Unit Description CE - Boiler

Installation Date	1957
Steam Output (10^3 lb/hr)	65
Design Pressure (psig)	
Final Steam Temp (°F)	
Furnace Type	Watertube
Furnace Size L-W-H (ft)	11 - 12 - 15
Furnace Area (ft^2)	66.9
Furnace Volume (ft^3)	1980
Burner Description	1 Peabody steam Atom. Oil Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	#6 Oil
Fuel Temp at Burner (°F)	285
Primary Air Temp (°F)	80
Stack Temp (°F)	400

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]
Unit [illegible]
Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MMtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MMtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in.H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a]at 3% O_2 dry

Location 39
Unit 2
Test No. 66-69

FUEL ANALYSIS SUMMARY

Coal and Oil Fuels

Test No.	Type of Fuel	Carbon, %	Hydrogen, %	Oxygen, %	Sulfur, %	Nitrogen, %	Ash, %	Moisture, %	Volatile Combustible, %	Fixed Carbon, %	Higher Heating Value	
											KJ/kg	Btu/lb
102-103	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	–	0.071	31.1	0.0452	19,440
107-108	#2 Oil	85.94	12.72	0.89	0.40	0.045	0.003	–	0.071	31.1	0.0452	19,440
111-112	#5 300 #85 Oil	86.46	10.31	1.07	1.29	0.77	0.10	–	0.50	35.1	0.0426	18,333
117-121	#6 Oil	85.95	10.31	0.22	2.74	0.31	0.03	–	–	–	0.0423	18,213
126-128	#6 Oil	No Fuel Sample Obtained For Analysis										
131-133	Coal	62.50	5.31	12.51	1.15	0.83	18.5	7.29	–	–	0.0276	11,863
134-139	Coal	68.30	4.70	11.81	1.16	1.46	9.72	3.66	–	–	0.0286	12,293
156-159	Coal	69.89	4.67	8.10	1.36	1.56	14.48	3.37	–	–	0.0296	12,300
159	#6 Oil	85.44	11.35	0.902	2.60	0.33	0.078	–	12.33	15.8	0.0432	18,560
160-164	#2 Oil	87.14	12.71	–	0.11	0.013	<0.001	–	0.027	35.1	0.0451	19,390
165-169	Coal	63.42	4.84	9.65	1.05	0.96	13.7	4.15	46.2	–	0.0276	11,873
169	Coal	62.50	5.12	12.51	1.15	0.83	18.5	7.29	–	–	0.0276	11,863
170-175	#6 Oil	86.60	10.94	0.31	1.60	0.36	0.25	–	9.80	15.1	0.0434	18,650
176-179	#6 Oil	86.17	11.55	–	1.91	0.38	0.07	–	–	–	0.0436	18,772
185-189	#6 Oil	85.10	11.10	3.12	0.19	0.29	0.08	–	8.53	35.7	0.0446	19,227
195-196	#6 Oil	86.68	12.16	0.65	0.37	0.14	0.005	–	1.61	35.2	0.0450	19,365

INDUSTRIAL BOILER DESIGN DATA

Location No. 19 Test No. 002-010 Unit No. 8 NG

Unit Description B&W Boiler

Installation Date	1974
Steam Output (10^3 lb/hr)	200
Design Pressure (psig)	800
Final Steam Temp (°F)	750
Furnace Type	Watertube
Furnace Size L-W-H (ft)	35' - 7' - 10
Furnace Area (ft^2)	8029
Furnace Volume (ft^3)	25492
Burner Description	1 B&W Spinel Burner
Horiz. Burner Spacing (ft)	
Vert. Burner Spacing (ft)	
Test Fuel	Natural & Refinery Gas
Fuel Temp at Burner (°F)	
Primary Air Temp (°F)	Ambient
Stack Temp (°F)	330

Comments:

BOILER EMISSION MEASUREMENTS
AND CONTROL NOON DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.							
Test Type							
Test Load (10^3 lb/hr)							
Excess O_2 (%)							
NO_x (ppm)[a]							
NO (ppm)[a]							
CO_2 dry (%)							
CO (ppm)[a]							
HC (ppm)[a]							
SO_x (ppm)[a]							
SO_2 (ppm)[a]							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)							
Final Stm Temp. (°F)							
Combus. Air Temp. (°F)							
Stack Temp. (°F)							
Fuel Flow [illegible]							
Fuel Temp. (°F)							
Fuel Pres. (psig)							
Furnace Pres. (in. H_2O)							
Register (% open)							

[a]at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL IRON DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$(S)_2$ dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(S) (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*							
NO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)	[illegible]		[illegible]			[illegible]	
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)							
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL NOX DATA

Location: [illegible]

Unit: [illegible]

Fuel: [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL RKIN DATA

Location [illegible]
Unit [illegible]
Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)							
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location [illegible]
Unit [illegible]
Fuel [illegible]

Test No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Test Load (10^3 lb/hr)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excess O_2 (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
O_2 dry (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CO (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_x (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SO_2 (ppm)[a]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solid Part. (lb/MBtu)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Boiler Efficiency (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Smoke Spot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opacity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Final Stm Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combus. Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Flow [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Temp. (°F)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Pres. (psig)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnace Pres. (in. H_2O)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Register (% open)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a] at 3% O_2 dry

BOILER EMISSION MEASUREMENTS
AND CONTROL ROOM DATA

Location SG
Unit # NB
Fuel Natural & refinery gas

Test No.	2012-11	2012-12	2012-13	2012-14	2012-15	2012-16	2012-17
Test Type	B/A	B/A	B/A	B/A	B/A	B/A	B/A
Test Load (10^3 lb/hr)	92.0	92.5	93	92.5	93	93	93
Excess O_2 (%)	2.4	2.2	2.1	2.0	2.9	2.6	2.8
NO_x (ppm)*	143	142	142	132	141	131	130
NO (ppm)*	128	127	126	121	129	129	130
$(O)_2$ dry (%)	5.9	6.4	7.0	8.2	9.0	8.0	7.9
CO (ppm)*	0	0	104	581	2000	4000	510
HC (ppm)*	0	0	0	0	0	0	0
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)					84		
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	600	600	600	600	600	600	600
Final Stm Temp. (°F)	750	750	750	750	750	750	750
Combus. Air Temp. (°F)	Amb.						
Stack Temp. (°F)	317	310	309	297	298	295	302
Fuel Flow ft^3/hr	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Fuel Temp. (°F)							
Fuel Pres. (psig)	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Furnace Pres. (in. H_2O)	-0.5	-1.0	-1	-1	-1	-1	-1
Register (% open)							

*at 3% O_2 dry

BOILER EMISSION MEASUREMENTS AND CONTROL ROOM DATA

Location [illegible]

Unit [illegible]

Fuel [illegible]

Test No.	[illegible]						
Test Type	[illegible]						
Test Load (10^3 lb/hr)	[illegible]						
Excess O_2 (%)	[illegible]						
NO_x (ppm)*	[illegible]						
NO (ppm)*	[illegible]						
$(\%)_2$ dry (%)	[illegible]						
CO (ppm)*	[illegible]						
HC (ppm)*	[illegible]						
SO_x (ppm)*							
SO_2 (ppm)*							
Total Part. (lb/MBtu)							
Solid Part. (lb/MBtu)							
Boiler Efficiency (%)							
Smoke Spot No.							
Opacity (%)							
Final Stm Pres. (psig)	[illegible]						
Final Stm Temp. (°F)	[illegible]						
Ambient Air Temp. (°F)	[illegible]						
Stack Temp. (°F)	[illegible]						
Fuel Flow (ft³/hr)	[illegible]						
Fuel Temp. (°F)							
Fuel Pres. (psig)	[illegible]						
Furnace Pres. (in H_2O)	[illegible]						
Register (% open)							

*at 3% O_2 dry

Location 39
Unit 8 #8
Test No. 107-32

Test No.	Type of Gas	N_2 %	CH_4 %	C_2H_6 %	C_3H_8 %	C_4H_{10} %	C_5H_{12} %	C_6H_{14} %	H_2 %	CO_2 %	H_2S %	O_2 %	AGA %	Heating Value Dry BTU/ft³	Heating Value Sat. BTU/ft³	Other Heating Value Dry BTU/ft³	Other Heating Value Sat. BTU/ft³
101	Nat.	94.72	4.26	0.29	0.063	0.055	0.032	–	0.29	0.23	0.27	0.60	0.705	0.9447	0.9288	1042	
104-105	Nat.	94.52	4.26	0.29	0.063	0.055	0.032	–	0.29	0.23	0.27	0.60	0.705	0.9447	0.9288	1042	
106-110	Nat.	91.88	3.82	0.40	[illegible]	–	–	–	0.32	–	0.60	–	0.706	[illegible]	0.9364	976	
111-115	Nat.	88.11	4.33	0.48	0.15	0.09	0.02	–	0.47	–	5.06	0.34	0.705	0.9473	0.9311	1039	
116-120	Nat.	88.11	4.33	0.48	0.15	0.09	0.02	–	0.47	–	5.06	0.34	0.705	0.9473	0.9311	1039	
121-125	Nat.	91.0	3.84	0.35	0.08	0.01	0.01	–	–	–	–	–	0.700	0.9404	0.9239	1030	
126-130	Nat.	75.40	5.33	0.39	0.40	0.14	–	0.007	0.40	–	0.40	–	0.705	0.9472	0.9306	1038	
131-135	Nat.	91.91	4.37	0.71	–	–	–	0.25	0.76	–	–	–	0.703	0.9453	0.9286	1047	
136-140	Nat.	94.39	1.90	0.33	0.40	0.01	–	–	0.60	–	0.39	–	0.704	0.9458	0.9277	1031	
141-145	Nat.	91.21	1.43	0.407	0.38	–	–	–	0.37	0.01	0.39	–	0.701	0.9405	0.9231	1023	
146-150	Nat.-Nat.	48.45	23.95	1.89	0.15	0.01	–	25.47	–	0.01	2.00	–	0.776	0.9755	0.9574	951	